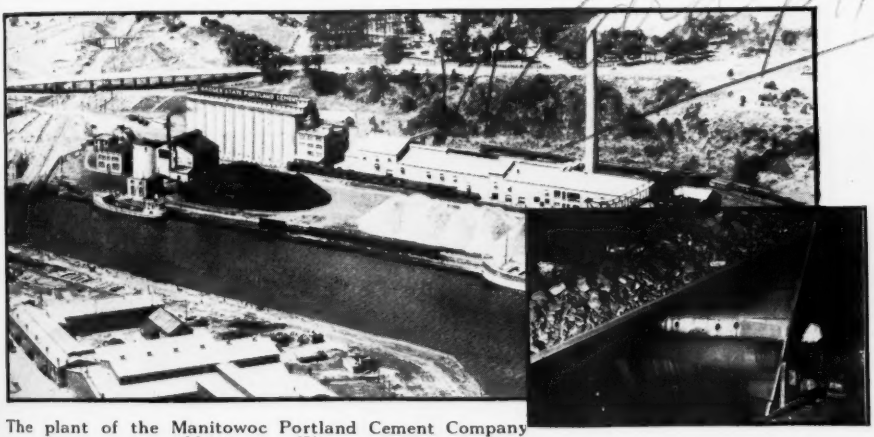
Pit and Quarry

SAND ▪ GRAVEL ▪ STONE

HANDLING ▪ CRUSHING ▪ SCREENING ▪ WASHING

Manitowoc Portland Cement Company Uses Ventilated "High Duty" Magnetic Pulley



The plant of the Manitowoc Portland Cement Company Manitowoc, Wis.

Under date of August 5, 1925, Mr. H. V. Vanderwerp, Manager, says: "We are pleased to advise that the Magnetic Manufacturing Company's Magnetic Pulley is giving us entire satisfaction."

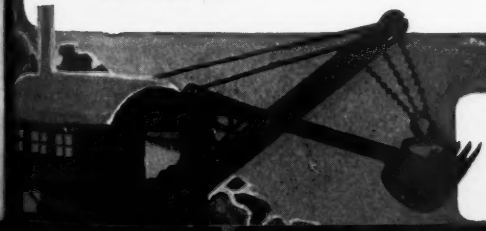
Crushing Plants **Foundries** **Pulverizing Plants**

"High Duty" Ventilated Magnetic Pulleys and Separators for Protection and Reclamation Problems.

Offices in Principal Cities. See telephone directory.

MAGNETIC MFG. CO.

201 24th Ave. MILWAUKEE, WIS.



August 15, 1925

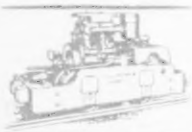
Index to Advertisers - - - - - - - Page 35
Table of Contents - - - - - Page 37

Circulation 7,600

Judge Them By Their Merits

When you buy a gasoline locomotive, buy it as you would hire men—on past performance.

Question users about "Whitcomb's"—their speed, efficiency, flexibility, economy and dependability, and from the information so gained—*"judge them by their merits."*



The FIRST SUCCESSFUL GASOLINE LOCOMOTIVE WAS BUILT IN 1906 IT WAS A WHITCOMB

We are glad to furnish you with the name of Whitcomb users in your vicinity. There are thousands of "Whitcombs" in service—many of them doing just the kind of work you want a locomotive to do. Write us for the name of a "Whitcomb" operator near you—go and see it in operation—we will let you be the judge.

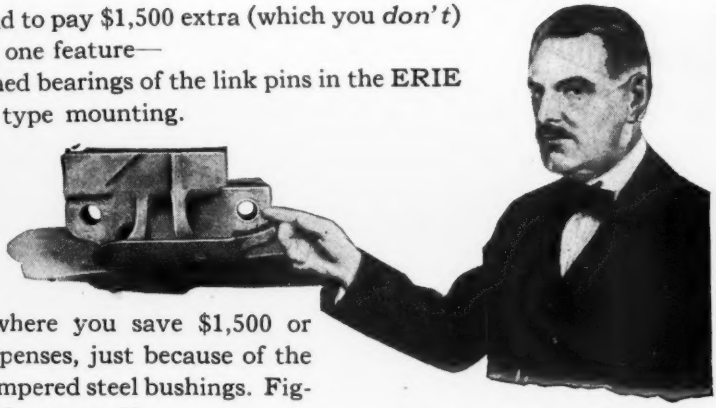
GEO. D. WHITCOMB COMPANY
ROCHELLE, ILLINOIS
Offices in principal cities

GASOLINE-STORAGE BATTERY-ELECTRIC
WHITCOMB
LOCOMOTIVES

You'd be money ahead inside of two years—

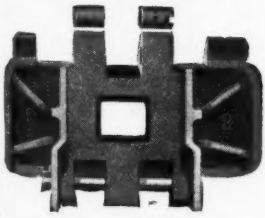
IF you had to pay $1,500 extra (which you *don't*) for this one feature—

The bushed bearings of the link pins in the ERIE caterpillar type mounting.



Here's where you save $1,500 or more in expenses, just because of the ERIE'S tempered steel bushings. Figure it out for yourself:

50 cents for two new bushings—



or $20 to $35 for a whole new tread?

A complete caterpillar tread link weighs about 100 pounds and costs $20 to $35 (the cost varies on different shovels).

A renewal bushing for an ERIE tread link weighs about half a pound, and sells for 25c. Two new bushings—fifty cents—make the bearing of an ERIE tread link *like new*. Only about 2% the expense you would have for a whole new link.

Think of the saving on replacements!

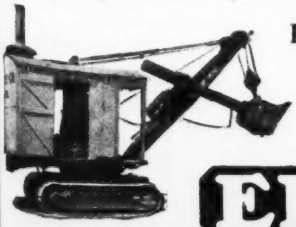
And there's very little wear at the ERIE'S link-pin bearings—because they are bushed with tempered steel, and besides are protected by a special oil that feeds out automatically from a reservoir in the link.

If the operator fills the oil pockets every two or three weeks (depending on the traveling done) these bearings will show hardly any wear after moving hundreds of miles.

The ERIE'S *high carbon* steel treads—heat treated, fitted with tempered spring steel bushings, and fully lubricated at the pins—are just one more example of "the ERIE way of doing things." You find points like this all over the machine.

No wonder ERIES cost only ⅓ as much for upkeep, as shown by hundreds of records.

Nor is it any wonder that far and away more "B" ERIES have been bought, than any other ¾ cu. yd. shovel. (More than 3,550 ERIES now in service.)



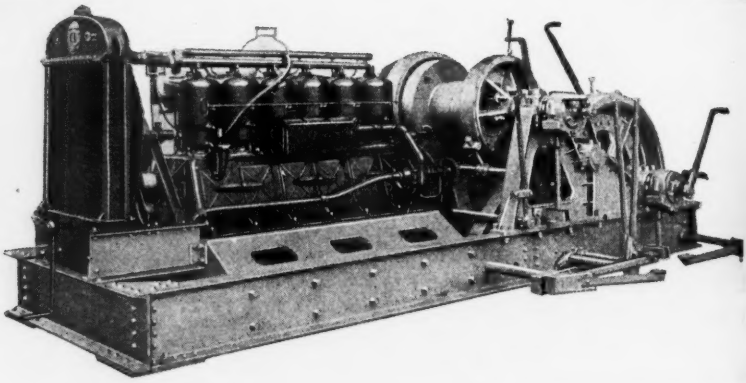
ERIE STEAM SHOVEL CO., Erie, Pa., U.S.A.

Builders of ERIE Shovels, Cranes, Draglines, etc.

Branch Offices: Boston, New York, Philadelphia, Pittsburgh, Atlanta, Chicago

Representatives throughout the U. S. A.

ERIE Revolving Shovels



TWIN CITY ENGINES

THE Washington Iron Works have found the Twin City Engine a sturdy, reliable power plant for the Logging Engine shown above which has proved its advantage over the old steam "donkey." Specify Twin City Engines on **your** equipment. Manufactured in sizes 35 to 140 H.P. Write for literature and specifications.

Other Twin City Users:

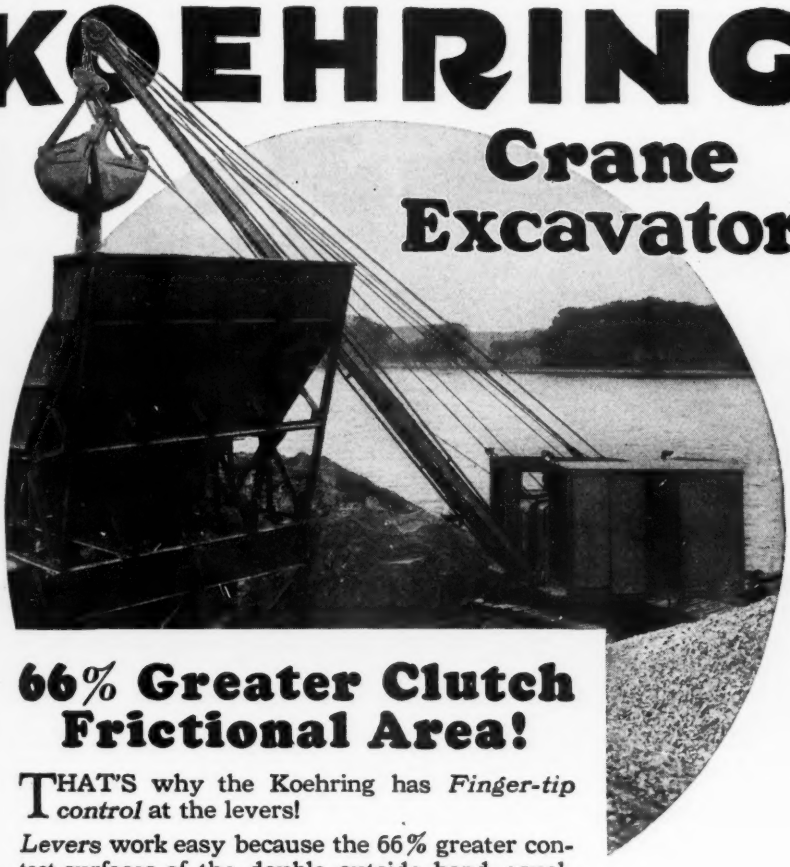
Austin Mich. Corp.
Baldwin Locomotive Works
Buckeye Traction Ditcher Co.
Bucyrus Co.
The Parsons Co.
Northwest Eng. Co.
The Harnischfeger Corporation
Pennsylvania Pump & Compressor Co.
Russell Grader Mfg. Co.
Star Drilling Mch. Co.
Willamette Iron & Steel Works, Etc.

TWIN CITY COMPANY
MINNEAPOLIS, MINN.
Heavy Duty Engine Manufacturers Since 1903

"BUILT TO DO THE WORK"

KOEHRING

Crane Excavator



66% Greater Clutch Frictional Area!

THAT'S why the Koehring has *Finger-tip control* at the levers!

Levers work easy because the 66% greater contact surfaces of the double outside band, equalizing friction *clutch* makes the levers work easy!

So, you have Finger-tip control without mechanical complications to help shift levers which ought not to be hard shifting in the first place. The Koehring operator does not lose the *"feel"* of the bucket —an important factor in accuracy of operation!

Crane Capacities

No. 1—10 tons at 12 ft. radius. Clamshell buckets loaded with sand or gravel: 1 cu. yd. bucket weighing 3450 lbs. at 28 ft. radius, ¾ cu. yd. bucket weighing 2600 lbs. at 34 ft. radius. Boom lengths to suit conditions. 4 cylinder, 5" x 6" gasoline engine, 1000 R.P.M.

No. 2—15 tons at 12 ft. radius. Clamshell buckets loaded with sand or gravel: 1¼ cu. yd. bucket weighing 3850 lbs. at 32 ft. radius. 1 cu. yd. bucket weighing 3450 lbs. at 36 ft. radius. ¾ cu. yd. bucket weighing 2600 lbs. at 43 ft. radius. Boom lengths to suit conditions. 4 cylinder, 5¾" x 7" engine, 1000 R.P.M.

KOEHRING HEAVY DUTY

Write for Crane Excavator Bulletin No. Cr. 32.

KOEHRING COMPANY

PAVERS, MIXERS—GASOLINE CRANES, DRAGLINES AND SHOVELS

MILWAUKEE, WISCONSIN

Sales Offices and Service Warehouses in principal cities

Foreign Dept., Room 1370, 50 Church St., N. Y.
Canada, Koehring Company of Canada, Ltd., 105 Front St., East, Toronto, Ontario.
Mexico, F. S. Lapum, Cinco de Mayo 21, Mexico, D. F.

A2688

Marion Model 32, 1¼ cu. yd. Electric Shovel owned by Tarbox-McCall Stone Co., Findlay, Ohio

Something to think about

Fueling a boiler, like feeding a crusher or clay mixer, is uneconomical for intermittent work. A Marion Electric will dig your daily output in a few hours as easily and at less cost per yard than a steam shovel. It does not cost you a cent for fuel while it stands idle.

Come to Shovel Headquarters

Where working conditions are suited to electric installations, many economies can be effected. Especially is this true when the operations are intermittent and the shovel is idle for considerable time at different periods during the progress of the work, as at these times no current is used except when the machine is in actual operation.

2304

MARION

The Marion Steam Shovel Co., Marion, Ohio, U. S. A.

THE INSLEY EXCAVATOR

Not to do the work of a large shovel—But to do the work a large shovel can't do—PROFITABLY

Approximately 7 Pounds Per Sq. Inch Bearing Pressure in Either Case

IN order to work a machine must be able to get to the job, this necessitating passage over anything from soft asphalt streets to marshy bog land. An Insley with its low bearing pressure on crawlers will stand up under conditions which would make passage impossible with almost any other shovel.

And after it gets to the job the way it will dig is a revelation to those who are not familiar with recent developments in light excavator design, a development of which the Insley is the outstanding example. The cutting pressure on the bucket edge is equal to that of the average large excavator. A machine of comparatively low first cost for

Shovel - Ditcher Skimmer or Crane Service

Write for Catalog No. 47

INSLEY

CONCRETE PLACING EQUIPMENT
STEEL DERRICKS
BUCKETS AND CARS
EXCAVATING EQUIPMENT

INSLEY MANUFACTURING CO.
Engineers and Manufacturers
INDIANAPOLIS

THE INSLEY IS LITERALLY A DIRT EATER EXCAVATOR

The New 204

½ Yd.

Follow the Corduroy Trail—the "Tread" Mark of the P&H

Here's the Reminder— Mail It— NOW!

Harnischfeger Corporation, 3851 National Ave., Milwaukee, Wis.

Please send a copy of Bulletin 82-X, which tells all about the new, light and speedy P & H Gasoline Excavator—Model 204.

Name .....

Address .....

City and State .....

The Short Tail Swing 8'-4"

Ideal Where Space is Limited

A new model—a ½-yard excavator—of standard P & H construction especially suitable for use where space is limited, as in alleys, basements and similar locations.

The tail swing is shorter by two feet than the 206 Model—fast on its corduroy traction—low bearing pressure—swing speed of 5.4 R. P. M.—complete metal cab—power clutch control—accessible—and convertible into dragline, clam-shell crane, magnet crane, pile-driver, skimmer scoop.

This new lighter machine may just fill your requirements. Bulletin 82-X gives all the facts. Mail coupon.

HARNISCHFEGER CORPORATION
Successor to
PAWLING & HARNISCHFEGER CO.
Established in 1884
3851 National Avenue, Milwaukee, Wis.

New York	Chicago	Memphis
Dallas	Kansas City	Los Angeles
Philadelphia	Detroit	Seattle
Birmingham	Minneapolis	Portland
San Francisco	Pittsburgh	Jacksonville

Warehouses and Service Stations:
New York Memphis Jacksonville San Francisco Los Angeles Seattle

P&H GASOLINE SHOVEL

What You Want In a Steam Shovel

IS the ability to give you results, to do the work right and at the least possible expense. It must save time as well as labor and stand up under working conditions.

The Modern Massillon Steam Shovel will prove these qualifications and more. It can be used with clamshell or dragline equipment, or as a locomotive crane. Send for descriptive booklet.

THE RUSSELL & CO.

MASSILLON, O.

(Established 1842)

The MODERN MASSILLON

Steam — 3/4–7/8 RANGE — Shovel

TRADE ROL-MAN MARK

MANGANESE STEEL

Dredge, Pontoon and Land Pipe of Manganese Steel Sheets or Plates Riveted or Welded

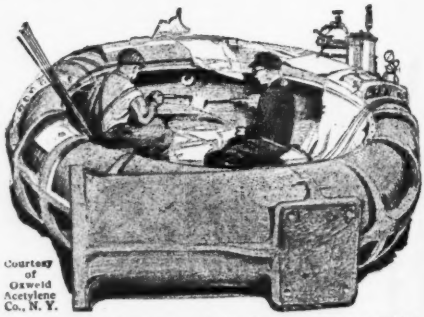
Highest Abrasive Resistance, Longest Life, Lightest Weight

ROL-MAN MANGANESE STEEL ELECTRODES and WELDING RODS

REDUCE YOUR SCRAP PILE

Don't scrap your worn pump casing and runners.

Reline and repair them with Rol-Man welding rods at a fraction of the cost of new parts.



Courtesy of Oxweld Acetylene Co., N. Y.

Salvaging a sand sucker or centrifugal pump casing at a SAVING of over $2,000 for a new casting and 10 weeks' delay.

CHEMICAL ANALYSIS

Manganese	12.00 — 15.00%
Carbon	1.00 — 1.45%
Phosphorus	.05 — .09%
Sulphur	.01 — .03%
Silicon	.10 — .20%

ROL-MAN Rods for Cas and Electric Welding are the same analysis, the high Manganese and Carbon content insuring a true Manganese Steel Weld by either Process.

Highest Abrasive Resistance of Any Steel Made

TOUGH—STRONG—NON-MAGNETIC

Don't scrap your worn or broken Manganese Steel castings and forgings, weld them with ROL-MAN—good as new

See also page 54

MANGANESE STEEL FORGE CO.

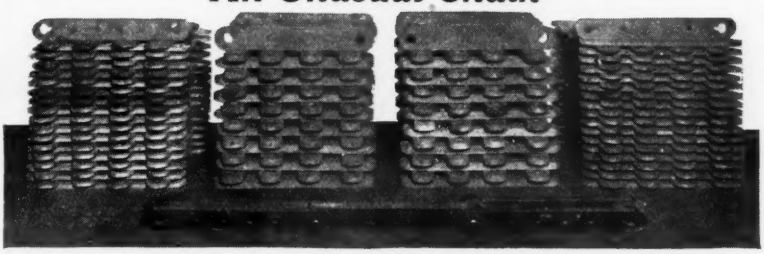
RICHMOND STREET AND ERIE AVENUE, PHILADELPHIA, U. S. A.

Manufacturers of "Rol-Man" Rolled and Forged Manganese Steel Products

TRADE ROL-MAN MARK

ROL-MAN Flat Link Manganese Steel Chains

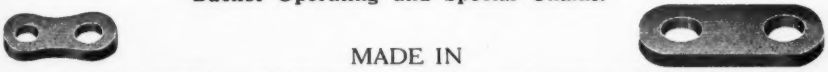
An Unusual Chain



This photograph shows the longest, strongest and heaviest rolled manganese steel flat link dredge chain ever made. This chain is over 400 feet long, single strand with 24-inch pitch and weighs 4½ tons. The center links are 1½ inches thick, 4 inches wide, 30 inches long with 1 13/16-inch round pin holes. The side links are ¾ inch thick, 4 inches wide, 30 inches long with 1 13/16-inch keyed pin holes.

This chain is made from "Rol-man" manganese steel rolled bars having a tensile strength of 150,000 pounds per square inch and a shearing strength of 100,000 pounds per square inch. The steel is heat treated, and all holes were punched from the solid bar to gauge, giving extreme accuracy of pitch and diameter, shape, size and location of all holes. Manufactured for one of the large river dredges in operation on the Ohio River in the Pittsburgh District.

ROL-MAN Manganese Steel Flat Link Chains for all purposes—Dredge, Elevator, Conveyor, Drag, Draw Bench, Tractor Drive, Bucket Operating and Special Chains.



MADE IN

ALL SIZES — PITCHES — SHAPES and SIZE OF HOLE

Pins, Bushings, Rivets, Shafts, Gudgeons, Rollers, Wear Strips, Plate Washers and Bolts with Standard Thread or Cotter Pin Holes

Diminished interruptions to operation alone more than pay the whole cost of "Rol-Man" Manganese Steel Wearing Parts

Manufacturers of

"ROL-MAN Double Lock Mesh" Woven Manganese Steel Screens

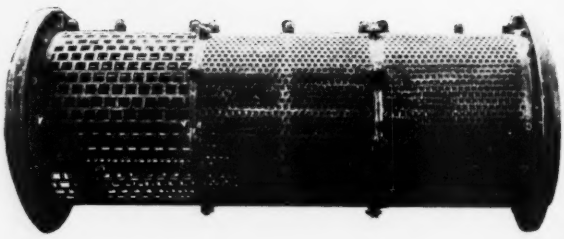
See also page 54

MANGANESE STEEL FORGE CO.

RICHMOND STREET AND ERIE AVENUE, PHILADELPHIA, U. S. A.

Manufacturers of "Rol-Man" Rolled and Forged Manganese Steel Products

From Cutter Head to Screen



"Era" Manganese Steel puts dependability into your Dredging Equipment.

All the way between Cutter Head and Screen wherever reliability of parts are essential, "Era" will act as "Operation Insurance."

"Era" Manganese Steel—"Has Made It's Way By the Way It's Made.

Send for Dredge Parts Bulletin.

HADFIELD-PENFIELD STEEL CO.

Bucyrus, Ohio

MANGANESE STEEL

ERA

THE FIRST - STILL LEADS IN QUALITY

LYMAN-RICHEY SAND CO.

OMAHA, NEBRASKA

February 21, 1925

American Manganese Steel Co.,
Chicago Heights, Illinois

Gentlemen:

ATTENTION: Mr. A. W. Daniels,
Gen'l. Sales Mgr.

Replying to your letter of February 11th regarding our opinion of pumps purchased from your company during the last five years; also pump parts and the life of same. I am enclosing copy of a report to our Mr. H. P. Curtis, President, on November 6th of last year which will probably answer fully the information you want.

We now have eight of your 10-inch units and ten 8-inch units at our various plants - 18 pumps in all - and assure you we are extremely well pleased with the service they are giving. Up until the year 1920 we used various types and makes of cast iron pumps and had a great deal of trouble in getting any pump which would stand the hard usage to which our pumps are subject on the Platte River operations. We have had little or no bearing trouble. Breakage of shells or side plates is absolutely unknown, and the life of the Amsco parts, we are satisfied, is five to six times the life of any of the old style pumps we used.

We hope this information will cover just what you want; however, if it does not, do not hesitate to write us further, and should you care to refer any prospective purchasers to the Lyman-Richey Sand Co., feel at liberty to do so.

Very truly yours,

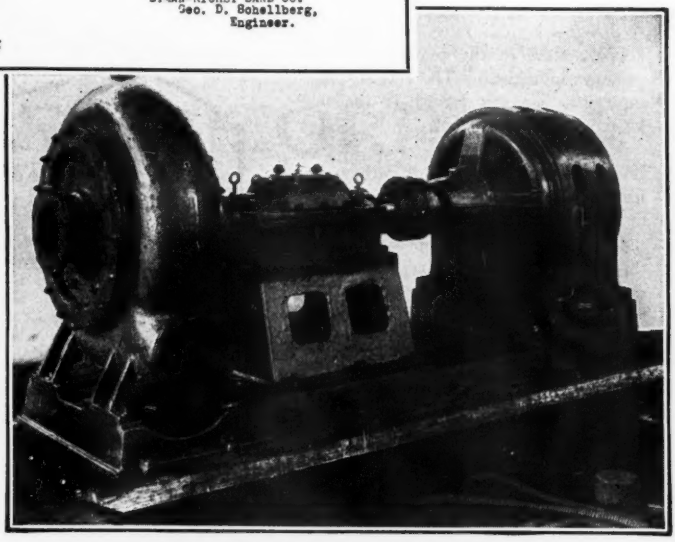
LYMAN-RICHEY SAND CO.
Geo. D. Schellberg,
Engineer.

GDS:EJ

Twenty AMSCO Pumps

Since this letter was written, two more Amsco units have been added to the Lyman-Richey operations.

Hundreds of other profit-making installations prove that you can't go wrong in adopting Amsco dredge pumps and repair parts in your work.

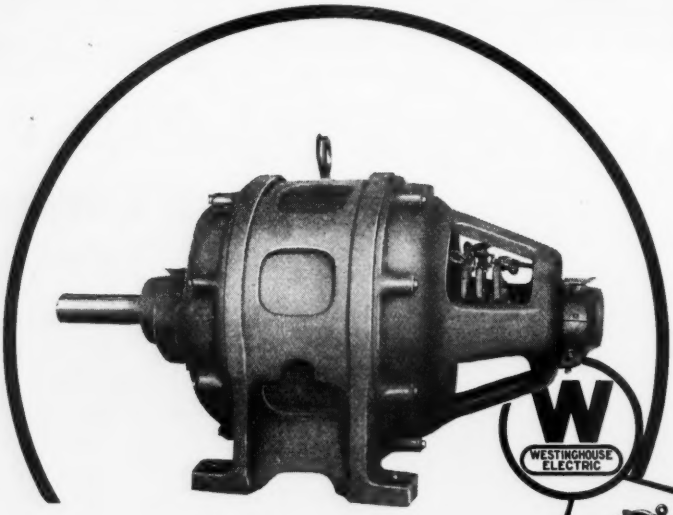


AMERICAN MANGANESE STEEL CO.

General Sales Offices: 388 E. Fourteenth St., Chicago Heights, Ill.

FOUNDRIES and SALES OFFICES: CHICAGO HEIGHTS, ILL.; NEW CASTLE, DEL.; OAKLAND, CAL.; LOS ANGELES, CAL.; DENVER, COLO.
SOUTHERN MANGANESE STEEL CO., ST. LOUIS, MO.

AMSCO



Shut Your Eyes *and*

YOU can do this safely if you know the the rock-bottom facts about Westinghouse motors in the cement and stone product industries. Their unsurpassed superiority for this service is too well-known to admit of doubt.

"Any old motors" won't do—they must have the "sand" to keep going and the "grit" to laugh off moisture, heat, vibration and sudden overloads. Westinghouse motors do this and more because they are built to stand up under strenuous operating conditions in many industries.

Progressive executives are saving time and money by simply specifying Westinghouse motors. Read at the right some reasons why you can confidently specify Westinghouse.

Westinghouse Electric & Manufacturing Company
East Pittsburgh Pennsylvania
Sales Offices in All Principal Cities of
the United States and Foreign Countries

Features of the CW Wound-Rotor Motor

—which particularly adapt it to service in the Rock Products Field

Sturdily designed frame to withstand shocks imposed by heavy duty service. Form-wound rotor coils are insulated for double the normal voltage.

Bearings are dust tight and proof against oil leakage.

Windings have best insulation obtainable. Mica used in slot portion of coils—more mica than will be found in any other motors.

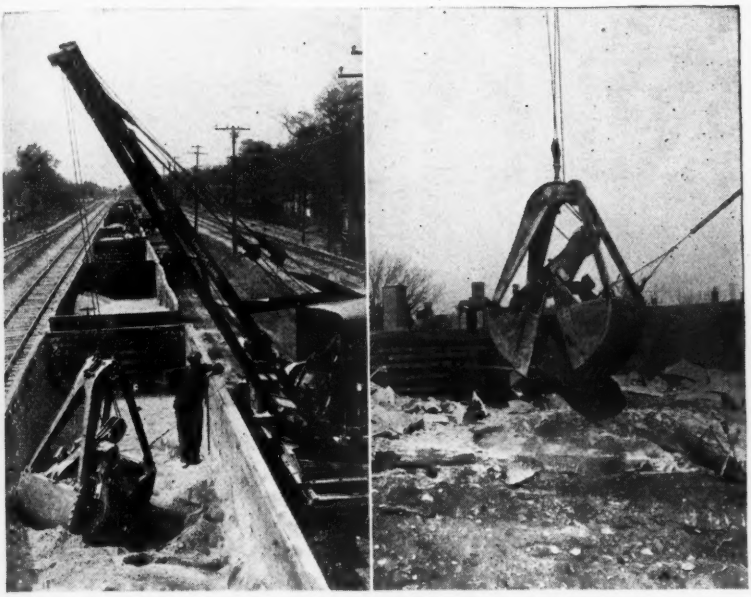
Shafts are axle steel which is much tougher and stronger than the machinery steel so generally used.

Westinghouse

X-82181

MEAD-MORRISON

RE-HANDLING **EXCAVATING**



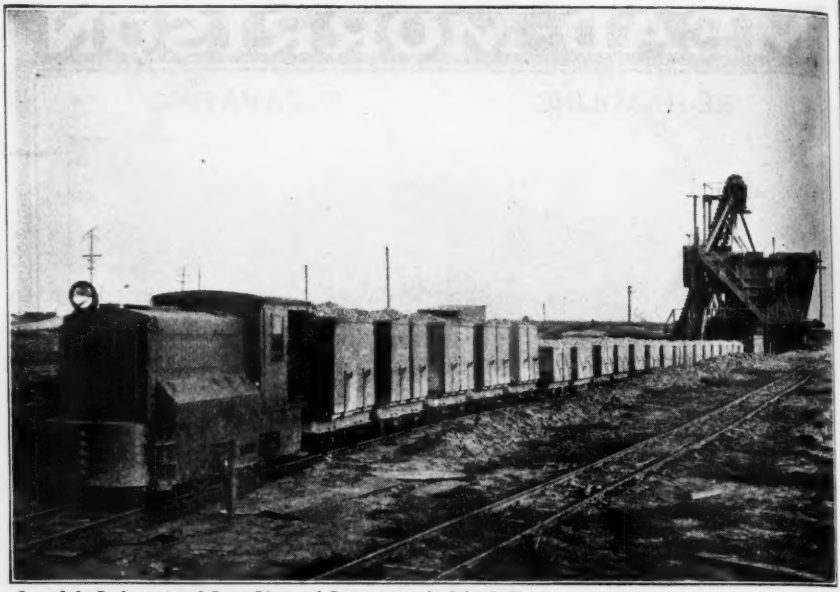
MEAD MORRISON
Double Duty Grab

The Mead-Morrison Type "W" Universal Grab—light, fast and powerful, rehandles and excavates equally well. When it lands the jaws hit first. They *dig down deep as they close* and fill the bucket for a capacity load every trip.

If *one double purpose* bucket instead of *two single purpose buckets* sounds like an interesting saving in equipment get in touch with our nearest office.

MEAD-MORRISON
MANUFACTURING COMPANY
828 PRESCOTT ST. EAST BOSTON, MASS.
Branch Offices: New York Montreal Chicago

HOISTING - HAULING - HANDLING



One of the Buda-equipped, 7-ton Plymouth Locomotives, built by the Fate-Root-Heath Co., Plymouth, Ohio, being used by the Kaiser Paving Co.

This Buda-powered locomotive pulls 27 cars 27 miles!

Recently the Kaiser Paving Company, of Oakland, Cal., was given the contract for a concrete road joining the Valley Boulevard with the Coast Line. All materials on this job are being hauled 27 miles from the railroad by three Buda-powered Plymouth locomotives, each pulling a string of 27 cars. Notwithstanding the length of the trip and the fact that a 1½ per cent grade is encountered at the start, these locomotives are towing their heavy loads with entire satisfaction and a notably low cost per ton-mile. Take full advantage of the extra value built into power machinery by the rugged, reliable Buda engine. Be sure that the locomotive, wagon loader, ditch digger, or other equipment you buy is Buda-equipped.

THE BUDA COMPANY, HARVEY CHICAGO SUBURB ILL.
ESTABLISHED 1881

Buy only genuine Buda Parts for the Buda engine
New Parts Catalog No. 432 now available

BUDA
The
ENGINE

Koppel Cars Are Used The World Over

This is a fine illustration of what Koppel can do in solving transportation problems—The Security Cement & Lime Company, Hagerstown, Md. Koppel Cars are cutting haulage costs here as they are doing in every line of industry in all parts of the world—have been doing it over 40 years.

All the knowledge gathered from this service and long experience is yours for the asking.

Our Bulletins give all the details of types and construction of Koppel cars and equipment. Our Engineers stand ready to submit plans. Address our nearest office.

KOPPEL INDUSTRIAL CAR & EQUIPMENT CO.

Koppel, Penna.

RAILS SWITCHES FROGS TRACK

KOPPEL

Sales Offices:

Pittsburgh New York Chicago San Francisco

KOPPEL *cars and tracks for QUARRIES*

Waukesha Motors and the World's Longest Suspension Bridge

Down to Rock Bottom

Digging the great foundations for the Philadelphia approach to the new Delaware River Bridge was done with power furnished by Waukesha "Ricardo Head" Industrial Power Units. Caruso & Gahagan, the contractors, chose Waukesha-motored P & H Shovels because they required guaranteed reliability of performance and low cost of operation. Throughout the long winter, operation of the shovel was continuous and uninterrupted even though century-old rock foundations had to be battered down.

There is a size of Waukesha Power Unit built to provide efficient, economical power for every Industrial job. "Industrial Power Units" is a book telling all about them—write for your copy.

WAUKESHA MOTOR COMPANY

Waukesha, Wisconsin

New York City	Hartford	Kansas City	Denver	Tulsa	Houston
Aeolian Building	*K. B. Noble Co.*	*V. L. Phillips Co.*	*Western Equip. Co.*	*C. F. Camp Co.*	*Portable Rotary Rig Co.*

Exclusive Builders of Heavy Duty Gasoline Engines for Nearly Twenty Years

TELSMITH
GRAVEL PLANT
SNAP-SHOTS

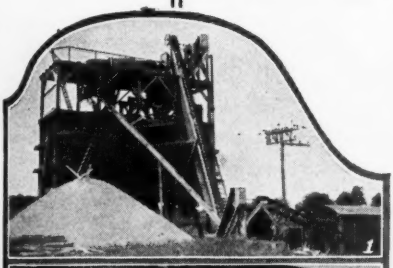
TELSMITH PRIMARY BREAKER (plate 3, bird's-eye view) is the master device for crushing gravel boulders. It exerts the full stroke on the big fellows that need the long pinch. Its steel frame, steel crown, unbreakable shaft, compact structure, force-feed lubrication—these features are milestones in the development of modern crushing practice. The Telsmith Primary Breaker is **guaranteed against breakage, even by tramp iron.**

TELSMITH PLATE FEEDER (plate 2) steadies the load on crusher, conveyor and screen. The stroke is adjustable to change the rate of feed. By preventing overloads, it improves the product, cuts maintenance expense, increases daily tonnage.

TELSMITH SAND TANK discharges clean, de-watered sand, as pictured in plate 5. It allows only 5% of free moisture to escape into the bins. This tank works just as reliably as the power plant of an ocean liner. Requires no power, no labor—not even supervision.

TELSMITH WASHING SCREEN (plate 4) scrubs and sizes the gravel in one cylinder, using a minimum of water, floor space and head-room. It saves almost its entire price in the reduced cost of transmission machinery and storage bins.

TELSMITH ENGINEERING SERVICE can't be photographed but is equally important. The best gravel plant will fail unless crushers, conveyors, screens and tanks are skillfully mated and intelligently combined into a single operating unit. One misplaced or undersize unit will impair the work of the whole outfit. Submit your problem to Telsmith engineers who have **specialized in quarry and gravel plant problems for eighteen years.** Your machinery will be designed, built, co-ordinated, balanced and guaranteed by the Telsmith organization. No "buck passing"—Telsmith stands behind the whole installation from crushers to bin gates. Glad to send you catalog No. GP-15. No obligation.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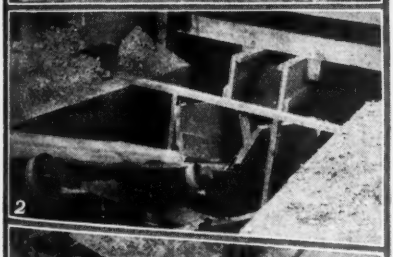
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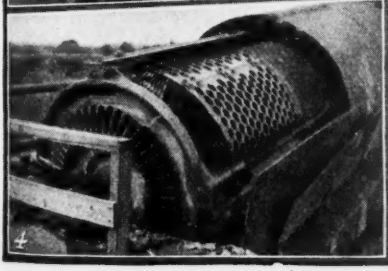
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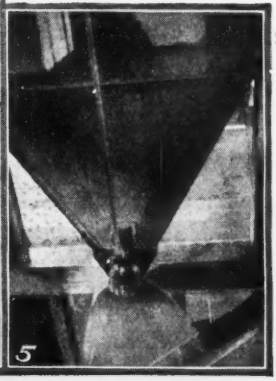
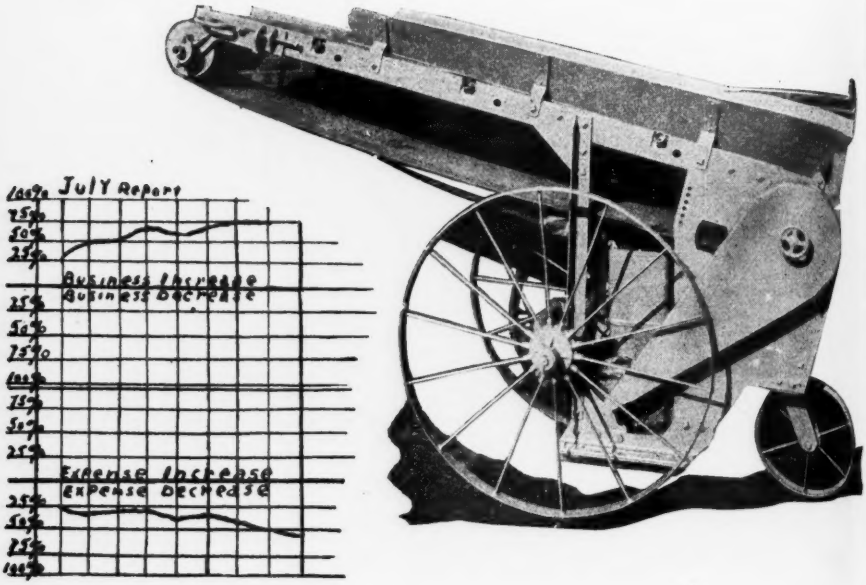

5

Smith Engineering Works

3183 Locust Street
Milwaukee, Wis., U. S. A.

18 East 41st Street New York City
Old Colony Building Chicago

Beckwith Machinery Co.
Pittsburgh and Cleveland



Decrease Your Expense

USE modern machinery to combat with labor problems of today. Increase your business and decrease your expense with Ottumwa Box Car Loaders.

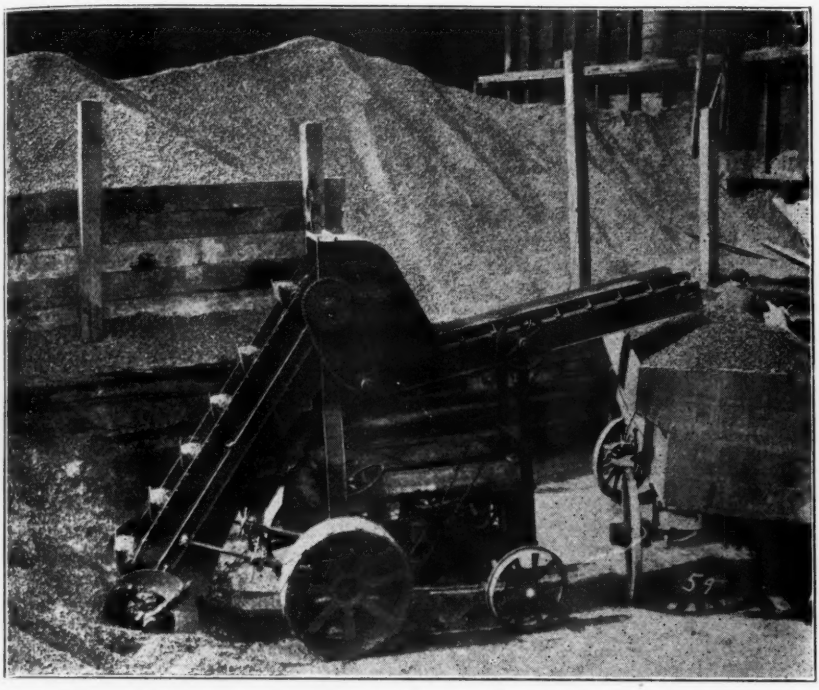
Make money with the Ottumwa. It reduces labor, eliminates loading costs, prevents delays, increases capacity and reduces costs. Increase your efficiency and your profits.

The Ottumwa Box Car Loader is manufactured with electric or gasoline power. It has roller and ball bearings throughout and latest improved Alemite greasing system.

Write for Complete Information and Prices

Ottumwa Box Car Loader Co.

OTTUMWA, IOWA



A Scientifically Correct Loader

The Specialty Fordson Loader is built scientifically correct. It is the result of our ten years' experience in the manufacture of portable wagon loaders. With a Fordson Tractor as a source of power it means simplicity of operation, dependability, ease of installation and Ford Service.

It has all the qualities that make for lowest loading costs, — speed durability, self-feeding, crowding, and digging power. It is easy to control and crowds while buckets are in operation independent of the reverse gear. It can be crowded much or little at a time, and the feeders clear a path sufficient for tractor wheels. The crowding mechanism is self-contained with gears running in oil.

Write us for further information.

SPECIALTY ENGINEERING CO.

Allegheny & Trenton Aves. Philadelphia, Pa.

Shot Moving Out

The Result

Results Like This Mean Low Production Costs

Grasselli Explosives for years have been the choice of quarry men who demand big production at low cost.

Getting the stone down in the size and condition you want means fast, continuous loading, whether by hand or shovel. With Grasselli Explosives you get a minimum of big blocks for secondary blasting and no dangerous overhangs. Work is speeded up and profits increased all along the line.

Your most difficult or unusual blasting problems will be quickly solved if you but call in a Grasselli Service Man to talk over the conditions in your quarry. His many years of experience with explosives in quarries throughout the country will be valuable to you in getting results that keep production costs down and increase profits.

Write our nearest branch; a Grasselli Service Man comes gladly and without expense to you when you need him.

THE GRASSELLI POWDER COMPANY

Main Office: Cleveland, Ohio

Branches:
Philadelphia
Bluefield, W. Va.
Birmingham
Wilkes-Barre, Pa.
Brownsville, Pa.

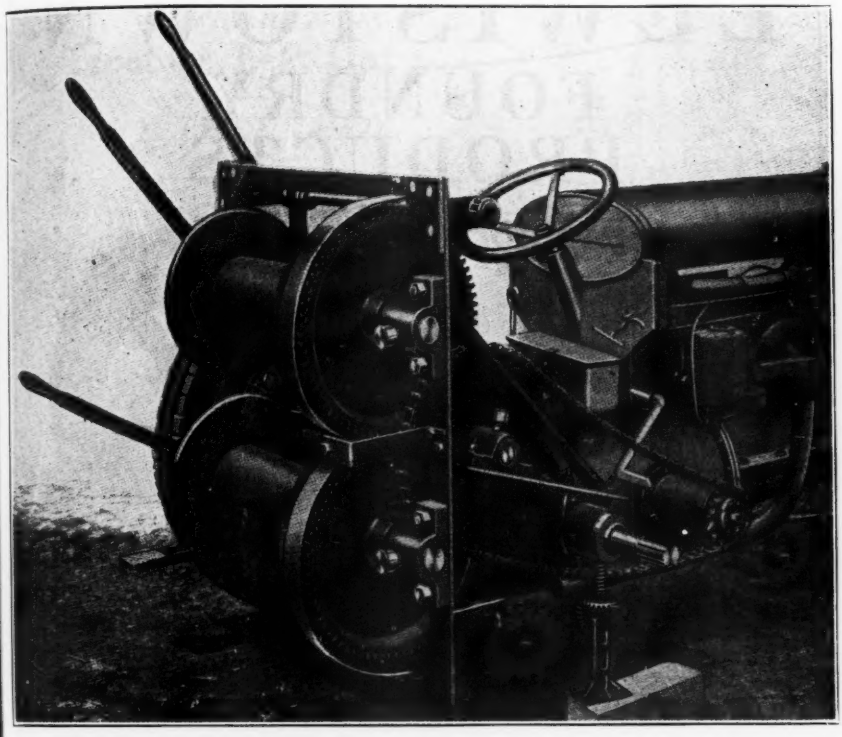
Manufacturers of CHEMICALS ZINC GRASSELLI EXPLOSIVES DYESTUFFS

Pittsburgh
Chicago
Clarksburg, W. Va.
Pottsville, Pa.
Hazleton, Pa.
New Castle, Pa.

The Grasselli Powder Co., of Florida, Miami, Florida

GRASSELLI EXPLOSIVES

Continental Winches



Ideal Dragline Hoisting Unit

FOR the sand and gravel operator who requires powerful, uniform hoisting energy every day in the week, Continental Winches make ideal hoisting units. They are excellent for either portable or stationary work. They are made in two types—friction drive and gear drive—and come in two sizes, single and double drum.

Fordson Continental Winches are all equipped with cut steel gears which will last indefinitely. All shaft bearings are babbitted and equipped with Alamite lubricating system. All are mounted on the rear axle housings, near the wheels, thus placing the weight where it should properly be.

The speed ranges from 60 to 200 ft. per minute on all lines. A speed of 200 ft. per minute can be had on the line with a motor speed of 1,000 R. P. M. and a load of 3,300 lbs. Other speeds and loads in proportion.

An unconditional guarantee against defective workmanship and material goes with every Continental Winch. Defective parts replaced F. O. B. Memphis without charge.

SPINKS SUPPLY CO.

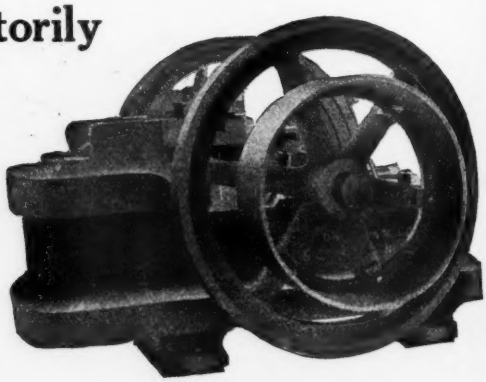
MEMPHIS, TENN.

LEWISTOWN FOUNDRY PRODUCTS

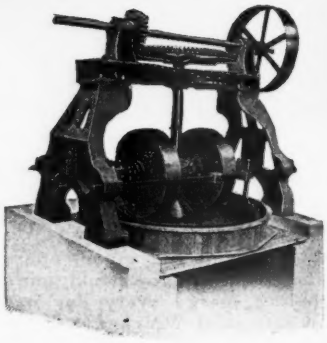
Will satisfactorily meet your

CRUSHING
GRINDING
SCREENING
WASHING
DRYING
ELEVATING

needs



We manufacture a line of equipment for the above purposes in pit and quarry service and shall be pleased to furnish you with any desired information on whatever class of equipment you are interested in.



9-Foot Dry Pan

40-ft. Continuous Bucket Elevator

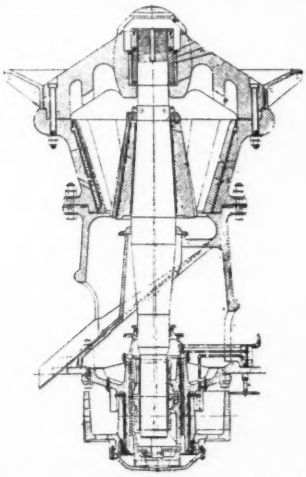
LEWISTOWN
FDY. & MACHINE CO.
LEWISTOWN, PA.

THE CRUSHERS

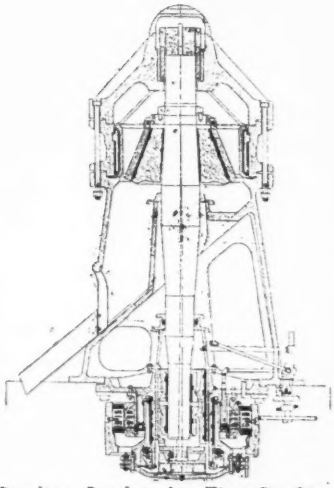
with the Troubles Left Out

WHY THEY LEAD

1—They are noiseless and run like watches.
2—50% greater capacity for same power.
3—Practically no wear on anything but head and concaves.
4—Short shaft and saving in head room with packed dust collars.
5—Shaft reinforced with self-locking head so that it cannot break where 90% of shafts have broken.
6—Can be driven right, left, or standard, as sent from shop.
7—Eccentric is turned by flexible coupling attached to pulley, which prevents side thrust and heating, as in geared crushers.
8—Ball and socket eccentric, self-aligning, eliminating friction and heating. Runs for years without attention.
9—Positive circulating oil system through filter and cut geared oil pump.
10—Made in our own shop by experts, trained for the job.
11—It is a crusher with the trouble left out. See it in operation, and you are unfit to listen to any geared crusher salesman. In fact, if you are near one of his machines, you can't hear him, if you are so inclined.
12—Our fine crusher does the work of 4 geared crushers.



Standard Ball Bearing Gearless Crusher. Sizes No. 1 to No. 60—Weights 1,000 to 900,000 lbs.



Gearless Crusher for Fine Crushing. Do not be deceived by Vertical Concaves; that is not what makes a fine crusher.

Send for catalogue and tell us what your problems are, and one of our experts will call on you without obligation on your part.

KENNEDY VAN SAUN MFG. & ENGR. CORP.

50 Church St. **NEW YORK**

Kearns Bldg., Salt Lake City, Utah
414 So. Spring St., Los Angeles, Calif.
Annex Hotel, St. Louis, Mo.

1739 Roanoke Bldg., Chicago, Ill.
73 Cullinan Bldg., Johannesburg, So. Africa
40, Rue des Mathurins, Paris, France

Probably you have noticed that sand and gravel plants always prosper when equipped with

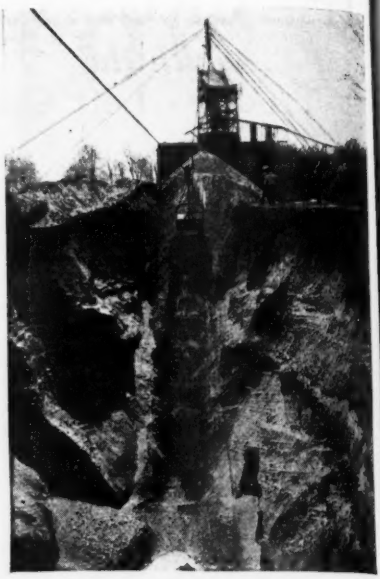
SAUERMAN

SLACKLINE CABLEWAYS

By digging from the pit and delivering direct to the screens in one rapid, simple operation, Sauerman Slackline Cableway Excavators enable their users to produce sand and gravel at the lowest cost per ton.

Sauerman cableways are universal in use, operating in many kinds of pits and in many classes of material. They are as efficient in wet pits or river deposits as in dry material. They are powerful diggers, able to handle large quantities of loose material, or to "nose into" masses of hard packed gravel and come out with a full load.

These machines dig to great depth and stretch out over a long span to excavate large quantities at one set-up. Usual operating spans are from 500 to 700 feet, but many successful plans are using spans up to 1,000 feet and over. The Sauerman excavating buckets range in capacity from ¼ to 3½ cu. yds.; so there is a size for any proposition, no matter how large or how small.



The picture above was taken three weeks after the pit was first opened up. The owner of this plant chose a Sauerman Slackline Cableway for his excavating and conveying unit because he had realized such good profits from his other Sauerman-equipped plant.

To get an idea of the variety of excavating and material handling problems that have been solved by Sauerman machines, just write for Pamphlet No. 22 in which about 100 different installations are illustrated and described.

SAUERMAN BROS., Inc.

434 S. Clinton St., Chicago

SAUERMAN

SLACKLINE CABLEWAYS : POWER DRAG SCRAPERS

Free Service to our readers

For the convenience of readers who are in the market for equipment, our "Free Service" department will furnish on request any information, catalogs and prices on any machinery, equipment or supplies used in pits and quarries. The coupon below makes it easy for you. Simply check, sign and mail.

Pit & Quarry, Rand McNally Bldg., Chicago, Ill.

Pit and Quarry, Research Department,
Rand McNally Bldg., Chicago, Ill.

WE ARE IN THE MARKET for the items checked below, and would be glad to receive catalogs, prices or other information.

- ☐ Agitators
- ☐ Air Compressors
- ☐ Air Compressors, Portable
- ☐ Babbitt Metal
- ☐ Baffles
- ☐ Bag Filling Machines
- ☐ Bag Sewing Mach.
- ☐ Bags, Cotton
- ☐ Bags, Paper
- ☐ Barges
- ☐ Barrels, Steel
- ☐ Belt Fasteners
- ☐ Belting, Conveyor
- ☐ Belting, Transmission
- ☐ Bin Gates
- ☐ Bins, Clay Tile Storage
- ☐ Bins, Concrete Storage
- ☐ Bins, Steel Storage
- ☐ Blasting Fuses
- ☐ Blasting Powder
- ☐ Block Machinery, Concrete
- ☐ Boiler Compound
- ☐ Boiler Skimmers
- ☐ Boilers
- ☐ Brick Machinery, Concrete
- ☐ Buckets, Conveyor
- ☐ Buckets, Grab
- ☐ Buildings, Portable
- ☐ Burners, Oil
- ☐ Cable Coatings
- ☐ Cableways
- ☐ Car Movers
- ☐ Car Pullers
- ☐ Car Replacers
- ☐ Car Wheels
- ☐ Cars, Bottom Dump (Gauge.....in.)
- ☐ Cars, End Dump (Gauge.....in.)
- ☐ Cars, Side Dump (Gauge.....in.)
- ☐ Cars, Steel Gondola
- ☐ Castings, Special Metal
- ☐ Chain Drive
- ☐ Chain, Conveyor
- ☐ Chain, Steam Shovel and Dredge
- ☐ Chaser Mills
- ☐ Chutes and Liners, Metal
- ☐ Classifiers
- ☐ Clips, Wire Rope
- ☐ Clutches
- ☐ Controllers, Electric
- ☐ Conveyor Equipment
- ☐ Conveyor Rollers
- ☐ Couplings, Flexible
- ☐ Cranes, Electric Traveling
- ☐ Cranes, Jib
- ☐ Cranes, Locomotive
- ☐ Cranes, Traction
- ☐ Crusher Parts
- ☐ Crushers, Disc
- ☐ Crushers, Gyratory
- ☐ Crushers, Hammer
- ☐ Crushers, Jaw
- ☐ Derrick Swingers
- ☐ Derricks
- ☐ Dippers
- ☐ Draglines, Cableway
- ☐ Draglines, Revolving Boom
- ☐ Dragline, Scraper
- ☐ Dredges, Dipper
- ☐ Dredges, Land
- ☐ Dredges, Sand Suction
- ☐ Drill Steel
- ☐ Drilling Contractors
- ☐ Drill Sharpening Machines
- ☐ Drills, Blast Hole
- ☐ Drills, Hand Hammer
- ☐ Drills, Tripod
- ☐ Dryers, Sand and Stone
- ☐ Dry Pans
- ☐ Dump Wagons
- ☐ Dust Collecting Systems
- ☐ Dynamite
- ☐ Dynamos, Electric
- ☐ Economizers, Fuel
- ☐ Elevating Equipment
- ☐ Engineering Service
- ☐ Engines, Gasoline (H. P.....)
- ☐ Engines, Gasoline Portable Power Unit (H. P.....)
- ☐ Engines, Hoisting
- ☐ Engines, Hydraulic Pumping
- ☐ Engines, Oil (H. P.....)
- ☐ Engines, Power Plant
- ☐ Engines, Steam
- ☐ Feeders
- ☐ Fire Alarms
- ☐ Fire Alarm Systems

(Continued on next page)

To be used for.....

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Firm Name.....

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City ..... State.....

- ☐ Fire Brick
- ☐ Frogs and Switches
- ☐ Fuses, Blasting
- ☐ Gas Producers
- ☐ Gears
- ☐ Generators, Electric
- ☐ Grapple, Stone
- ☐ Grate Bars
- ☐ Grates
- ☐ Gypsum Separators
- ☐ Hoisting Engines
- ☐ Hoists, Chain
- ☐ Hoists, Derrick
- ☐ Hoists, Drum
- ☐ Hose, Sand Suction
- ☐ Hydrators
- ☐ Hydraulic Mining Nozzles
- ☐ Hydraulic Pipe
- ☐ Hydraulic Pumping Engines
- ☐ Hydraulic Valves (Pulpit and Indicator)
- ☐ Idlers, Belt Conveyor
- ☐ Industrial Railway Systems
- ☐ Kettles
- ☐ Kilns, Cement
- ☐ Kilns, Lime
- ☐ Lights, Carbide
- ☐ Linings, Bag and Barrel
- ☐ Loaders, Bin, Portable
- ☐ Loaders, Boom and Bucket
- ☐ Loaders, Box Car
- ☐ Loaders, Conveyor
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- ☐ Locomotives, Gasoline (Gauge .....in.)
- ☐ Locomotives, Steam (Gauge .....in.)
- ☐ Locomotives, Storage Battery (Gauge .....in.)
- ☐ Log Washers
- ☐ Lubricators
- ☐ Magnetic Separators
- ☐ Manganese Steel
- ☐ Manganese Steel Parts
- ☐ Metal, Babbitt
- ☐ Metal, Perforated
- ☐ Meters
- ☐ Mills, Chaser
- ☐ Mills, Tube
- ☐ Mixers, Concrete
- ☐ Mixers, Plaster
- ☐ Motors, Electric (H. P.....)
- ☐ Motors, Gasoline (H. P.....)
- ☐ Motors, Gasoline Portable Power Unit (H. P.....)
- ☐ Motor Truck Dump Bodies
- ☐ Motor Trucks
- ☐ Nozzles, Hydraulic Mining
- ☐ Nozzles, Suction Screen
- ☐ Oil Burners
- ☐ Oils and Lubricants
- ☐ Perforated Metal
- ☐ Picks and Shovels
- ☐ Pipe, Hydraulic
- ☐ Pipe, Iron
- ☐ Pipe, Spiral
- ☐ Plows
- ☐ Post Molds, Concrete
- ☐ Powder, Blasting
- ☐ Powder Magazines, Steel
- ☐ Power Transmitting Equipment
- ☐ Power Unit, Gasoline, Portable (H. P.....)
- ☐ Pulverizers, Hammer
- ☐ Pulverizers, Ring
- ☐ Pulverizers, Roll
- ☐ Pump Repairs
- ☐ Pumps, Drainage
- ☐ Pumps, Dredging
- ☐ Pumps, Sand
- ☐ Pumps, Water Supply
- ☐ Pyrometers
- ☐ Rail, Steel
- ☐ Roofing and Siding (Iron, Steel, Zinc)
- ☐ Rope, Manila
- ☐ Rope, Wire
- ☐ Sand-Lime Brick Machinery
- ☐ Scales, Automatic, Conveyor
- ☐ Scales, Track
- ☐ Scrapers, Power
- ☐ Scrapers, Team
- ☐ Screening Equipment

(See other side)

- ☐ Screens, Perforated Metal
- ☐ Screens, Rotary
- ☐ Screens, Vibrating
- ☐ Separators, Air
- ☐ Separators, Gypsum
- ☐ Separators, Magnetic
- ☐ Separators, Sand
- ☐ Sheaves
- ☐ Shovels, Electric (.....yd.)
- ☐ Shovels, Gasoline (.....yd.)
- ☐ Shovels, Steam (.....yd.)
- ☐ Speed Reducers
- ☐ Steel Barrels
- ☐ Steel, Drill
- ☐ Steel, High Speed
- ☐ Steel, Manganese
- ☐ Steel, Structural
- ☐ Stokers, Automatic
- ☐ Stone Grapple
- ☐ Stripping Equipment, Power
- ☐ Superheaters
- ☐ Swinger, Derrick
- ☐ Tachometers
- ☐ Tackle Blocks
- ☐ Tampers, Concrete Block
- ☐ Tanks, Settling
- ☐ Tanks, Steel
- ☐ Tanks, Wood
- ☐ Ties and Timbers
- ☐ Tile Machinery, Concrete
- ☐ Track
- ☐ Track Scales
- ☐ Track Shifters
- ☐ Tractors, Caterpillar
- ☐ Tramways, Aerial
- ☐ Transformers, Electric
- ☐ Trolley Carriers
- ☐ Trucks, Electric
- ☐ Tube Mills
- ☐ Turbines
- ☐ Unloaders, Bin
- ☐ Unloaders, Boom and Bucket
- ☐ Unloaders, Conveyor
- ☐ Wagons, Dump
- ☐ Washers, Log
- ☐ Washing Equipment
- ☐ Welding Equipment
- ☐ Winches
- ☐ Wire Cloth

To be used for.....

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Firm Name.....

Address .....

City ..... **State**.....

Pull!

Sand to scrape out—gravel to dredge—great stones to lift—broken rocks to load—cars of limestone to drag uphill—the equipment varies, but the extraordinary pull power of Yellow Strand Wire Rope is equal to them all.

Powerful Yellow Strand, made of imported steel wire, will sustain the great stresses of pit and quarry until it has more than earned its cost in honest service.

Write for catalog—and name of nearest distributor of Yellow Strand and other dependable B. & B. Wire Ropes.

BRODERICK & BASCOM ROPE CO.

St. Louis, Mo.

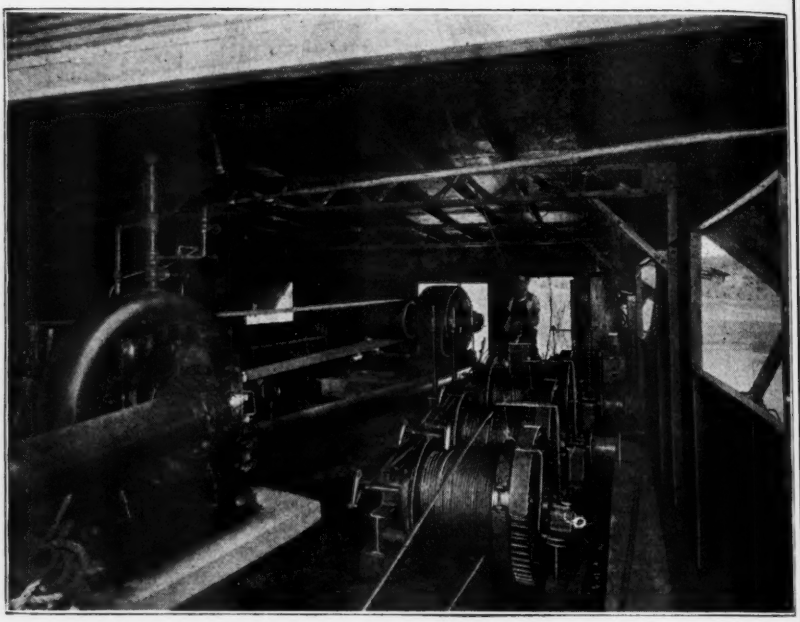
Eastern Office and Warehouse: 76 Warren St., New York City
Western Office: Seattle, Wash. Factories: St. Louis and Seattle

Builders of B & B Aerial Tramways for Industrial haulage

JR439

Yellow Strand WIRE ROPE

Lidgerwood Hoists



THE LIDGERWOOD HOIST shown in the above illustration operates on one of the steel dredges used by the Stewart Sand and Gravel Co., of Kansas City, Mo., a description of which is given on pages 81 to 88 of this issue.

EXCAVATOR HOISTS

Must have

STRENGTH

To stand the severe working strains

POWER

To insure ample and constant rope pull

SPEED

To give capacity

"LIDGERWOODS" have all these qualities

HOISTS—CABLEWAYS—DERRICKS

Of All Types

LIDGERWOOD MFG. CO., 96 Liberty St., New York

Philadelphia; Pittsburgh; Chicago; Seattle; Tacoma; Brown-Marx Bldg., Birmingham, Ala.; Los Angeles; Portland, Ore.; Columbus, Ohio. *Sales Agents:* Norman B. Livermore, San Francisco; Woodward, Wight & Co., Ltd., New Orleans; Canadian Allis-Chalmers, Ltd., Toronto; John D. Westbrook, Inc., Norfolk, Va.

Foreign Offices: London, England Sao Paulo, Brazil Rio de Janeiro, Brazil

CLYDE

Quarry Hoists and Derricks

STEAM-ELECTRIC

Illustrations show how the Clyde Portable Derrick operates on a wide track, along the river bank, taking sand from the barges and dumping it either in cars or on the stockpile. It also loads from stockpile to cars.

You'll take pride in your Clyde.

Clyde Iron Works Sales Company

Sole Distributors for CLYDE IRON WORKS, Duluth, U. S. A.

Stocks carried in the following Warehouses:

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You also, can get this information from your HAND BOOK

CALCIUM PRODUCTS COMPANY

HOLLIDAYSBURG, PA.

MANUFACTURERS OF

HIGH CALCIUM CHEMICAL LIME

J. D. HARTMAN
MANAGER

March 9, 1925

The Complete Service Publishing Co.,
Rand-McNally Building
Chicago, Ill.

Gentlemen:

This will acknowledge receipt of your Pit and Quarry Handbook for 1925.

For your information, we have had business dealings with not less than twenty-five of the manufacturers listed, this company as well as the J. L. Hartman Company which have been under one management in the past. Your handbook has been especially helpful in covering as it does their entire lines of quarry machinery and supplies. The information it contains is especially helpful in many problems.

We feel under great obligations to you for sending us a book of so much useful information, and desire to thank you very kindly for same.

Yours very truly,

J. D. Hartman

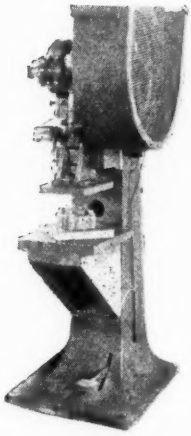
JDH-S

The habit of using Pit and Quarry HAND BOOK is a time and labor saving habit Within the covers of this book you will find the answers to your problems on operation and equipment. You will find information that can save you many a dollar and many an hour.

Pit and Quarry HAND BOOK

Rand, McNally Bldg. **Chicago, Ill.**

The Usco Valve Test which compresses months into minutes



This is the machine on which Usco Pump Valve stocks are given the endurance test developed by our factory. The method is simple. The test valve is placed in a special attachment and subjected to the same repeated shocks which it would get on a valve seat in actual use, but at a rate which compresses months of service into a few minutes.

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These Pump Valves are fitted for their job by scientific test

The essential thing in a pump valve is to have exactly the right composition for the service it is intended to perform.

With every stroke of the pump, a valve used on a straight port seat receives the full force of a stream of liquid coming through the ports on its way to the chamber. A valve which is not made of the proper grade of material for the work which it is doing very soon wears down in the areas opposite the port openings.

The eleven styles of Usco Valves, each made for its own type of service, are checked regularly by a new and sure form of factory test to make certain that they are exactly right before they are graded.

The immediate results have been both a new standard of uniformity in rubber pump valves, and notable improvements in compounds.

There is a style of Usco Pump Valve for every type of service.

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United States Rubber Company

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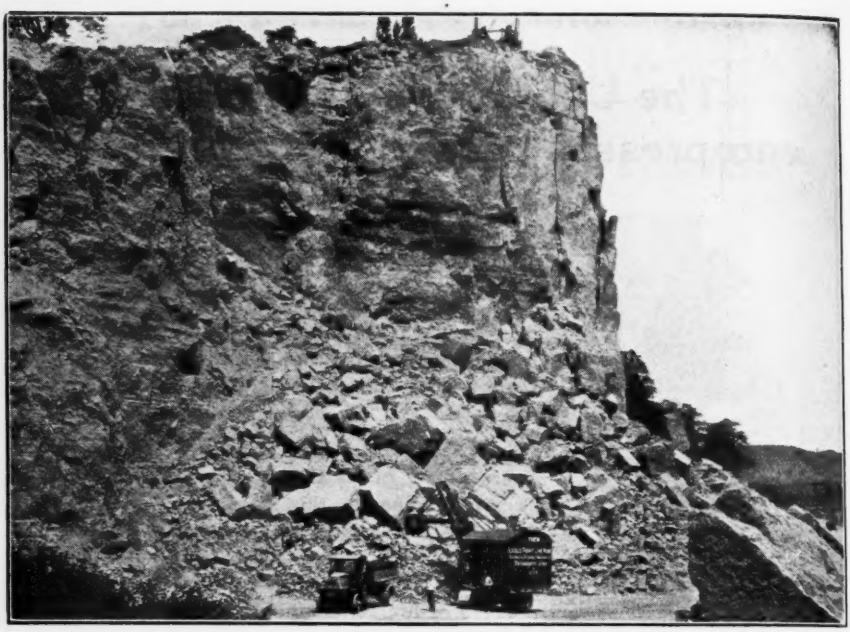
Branches In Every Industrial Center



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A Giant For Work

A shovel's value in quarry work can't be measured by size alone. Take the Eagle Point Lime Works at Dubuque, Iowa, as an example.

They have a ¾ yard Type O Thew Gasoline Shovel and for all around usefulness they say, "It can't be beat."

It loads fast. It easily places the big chunks for breaking up. When ready for a blast it can amble out of the way in a hurry, or move easily to another part of the quarry where it can keep busy.

It can be quickly converted into a clamshell crane for loading from the stock pile below the crusher when necessary.

Being gasoline operated, it is ready to start instantly anywhere, anytime.

The day of the huge, ponderous shovel in the quarry is about over. For all around usefulness, the smaller shovel is the better investment, especially if it is a Thew.

Let us refer you to other quarry owners who will tell you the same.

THE THEW SHOVEL COMPANY, LORAIN, OHIO

Thew Lorain Shovels

Dig Faster—Last Longer

Pit and Quarry

Index to Advertisers

VOL. 10 CHICAGO, ILL., AUGUST 15, 1925 No. 10

American Manganese Steel Co. 13
American Steel & Wire Co. 126
Atlas Car & Mfg. Co. 115
Austin Mfg. Co. 120

Bacon, inc., Earl C. 119
Bay City Dredge Wks. 117
Blaw-Knox Co. 118
Bradley Pulverizer Co. 120
Briggs and Turivas 111-113
Broderick and Bascom Rope Co. 29
Brookville Truck & Tractor Co. 125
Brown Hoisting Machy. Co. 70
Buckeye Dryer Co. 132
Buckeye Machine Co. 119
Buda Co. 16
Burch Plow Works Co. 126
Burnham, Royal E. 114
Burrell Eng. and Const. Co. 115
Byers Machine Co. 38

Caldwell and Son Co., H. W. 134
Chicago Perforating Co. 115
Clyde Iron Works 31
Conveying Weigher Co. 125
Curtis Pneumatic Machy. Co. 133

Deister Concentrator Co., The 128
Domestic Engine & Pump Co. 127

Eagle Iron Works 121
Easton Car and Const. Co. 124
Economy Pumping Machy. Co. 115
Egyptian Iron Works 123
Ensign-Bickford Co. 124
Equipment Corporation of America 108
Erie Steam Shovel Co. 3

Fate-Root-Heath Co. 68-69

Gay Co., Rubert M. 117
Georgia Iron Works 135
Grasselli Powder Co. 22
Green, L. P. 118
Gruendler Patent Crusher and Pulv. Co. 123

Hadfield-Penfield Steel Co. 12
Haiss Mfg. Co., Geo. 127
Harnischfeger Corporation 8
Heineken, W. P. 111
Hubbard Steel Foundry Co. 67
Hyman-Michaels Co. 109

Insley Mfg. Co. 7
Interstate Equipment Corp. 133

Kansas City Hay Press Co. 123
Kennedy-Van Saun Mfg. and Eng. Corp. 25
Kilby Frog and Switch Co. 118
Kingsford Foundry and Mach. Wks. 121
Koehring Co. 5
Koppel Industrial Car & Equip. Co. 17

Letson Co., T. H. 113
Lewistown Foundry and Mach. Co. 24
Lidgerwood Mfg. Co. 30

Loomis Machine Co. 116
Ludlow-Saylor Wire Co. 128

McGann Mfg. Co. 121
McLanahan-Stone Machine Co. 122
McNeal Machinery Co. 111
Magnetic Mfg. Co. ..... Front Cover
Manganese Steel Forge Co. 10-11
Marion Steam Shovel Co. 6
Mead-Morrison Mfg. Co. 15
Merrick Scale Mfg. Co. 116
Milwaukee Locomotive Mfg. Co. 121
Morris Machine Works 107
Mullins Body Corp. 130
Mundy Hoisting Engine Co. 115

New Holland Machine Co. 122

O. K. Clutch & Mchy. Co. 134
Orr & Sembower, Inc. 134
Osgood Co. 116
Ottumwa Box Car Loader Co. 20
Owen Bucket Co. 115

Pawling and Harnischfeger 8
Paxson Co., J. W. 116
Pennsylvania Pump and Compressor Co. 117
Pettibone Mulliken Co. 131
Punxsutawney Drilling and Contr. Co. .. 115

Randolph-Perkins Co. 115
Rennolds Equipment Co. 112
Russell & Co. 9

Schaffer Poidometer Co. 123
St. Mary's Oil Engine Co. 115
Sanderson Cyclone Drill Co. 129
Sauerman Bros. 26
Smith Engineering Wks. 19
Sonken-Galamba Corp. 111
Sonntag, C. H. 120
Southern Iron & Equip. Co. 108
Spear-Wells Machinery Co. 129
Specialty Engineering Co. 21
Spinks Supply Co. 22
Symons Bros. Co. 115

Tampa Shipbuilding and Engr. Co. 131
Thew Shovel Co. 34
Thomas Elevator Co. 119
Tips Engine Works 119
Twin City Co. 4

United States Rubber Co. 33
Universal Vibrating Screen Co. 117
Used Equipment Bargains 108-114

Venn-Severin Machine Co. 130
Vulcan Iron Works 36

Waukesha Motor Co. 18
Westinghouse Electric and Mfg. Co. 14
Whitcomb Co., Geo. D. 2
Williams, Co., G. H. 118
Williams Patent Crusher and Pulv. Co. ..... Back Cover
Wood Drill Works 120

Ask any of these users—*they know!*

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Alpha Portland Cement Co., Easton, Pa.
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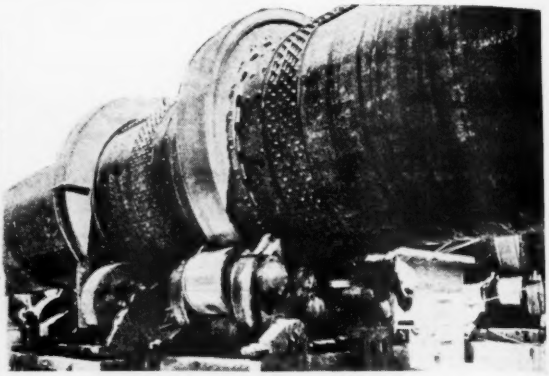

—and now they have 4 of these giants heaping up their production!

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Each of these Kilns is a 9 feet by 175 feet, two tire Rotary.

A fair idea of the sturdiness and massiveness of the vulcan construction can be obtained by a glance under the kiln shown in this photo. Note the tire and roller bearing supports under the tire, together with the thrust roller bearings.

In front of the tire is the girth gear with the driving gear tram.

No matter what your Kiln needs, you can depend upon Vulcan Engineers for that extra capacity and quality which distinguishes the Vulcan. Their extensive experience in designing and constructing in meeting the needs of the various kiln using industries has made possible the enviable performance of Vulcan Kilns wherever installed.

Perhaps you have a kiln problem to talk over with Vulcan Engineers. If so, let us know. In any case, send for the latest Vulcan Kiln Bulletin.

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VULCAN of WILKES-BARRE KILNS

Pit and Quarry

A Semi-Monthly Publication for Producers and Manufacturers of Sand Gravel, Stone, C ment, Gypsum, Lime and Other Non-Metallic Minerals.

VOL. 10 CHICAGO, ILL., AUGUST 15, 1925 No. 10

FEATURE CONTENTS

Arbitration of Commercial Disputes 39
An editorial concerning the new Federal Arbitration Act.

Hydraulic Features Important Factors in Modern Cement Plant Operation 41
E. D. Roberts discusses the operations of the Manitowoc Portland Cement Company at Manitowoc, Wisconsin.

Pumping Problems in the Cement Industry 55
C. H. Sonntag analyzes the problem of pumping in both the dry and the wet process cement mill.

Employing Efficient Hydraulic Methods in Producing From Bank Deposit 63
An illustrated description of the new plant of the Diamond Sand Company at Lake Wales, Florida, with which is incorporated some data on Florida's non-metallic mineral resources.

The Most Unique Hydraulic Operation in the Sand and Gravel Industry 71
The new and mysterious method of excavating sand being used by the Ward Sand and Gravel Company at the largest plant in the world is discussed and illustrated.

Hydraulic Stripping 77
G. B. Massey presents some useful tables and interesting data on the most approved methods of stripping.

Modern Hydraulic Methods Produce Famous Classified Sand 81
An unusual discussion concerning John Prince and the Stewart Sand Company which has applied engineering to sand production and modern business methods to its distribution with great success.

Analyzing Freight Rate Problems in the Non-Metallic Industry 89
The Second Article by L. E. Whitney, a traffic expert, concerning outstanding examples of rate discriminations.

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THE ALL-PURPOSE ONE MAN CRANE

Pit and Quarry

Vol. 10 Chicago, Ill., August 15, 1925 No. 10

Arbitration of Commercial Disputes

DURING a recent conference with one of Chicago's leading corporation lawyers, the subject of arbitration of commercial disputes in relation to the new Federal Arbitration Act was being discussed. The result of this conference is given largely in our viewpoint here.

On January 1st, 1926, the Federal Arbitration Act will go into effect. It provides that, if a contract contains a written agreement to submit any controversy concerning the contract to arbitration, that agreement is valid, irrevocable and enforceable in the federal courts. The matter of including the arbitration clause in the contract is entirely voluntary; but if it is included, it cannot be ignored. The parties to the contract must arbitrate in case of dispute. This puts the authority of the court behind private arbitration action; for the court will enforce the award rendered by the arbitrators if the parties concerned refuse to accept it. Of course, there are provisions in the law to ensure justice. Parties may choose their own arbitrators; but they must choose one or more or the court will appoint them. In case of possible fraud or misconduct, the court may review the arbitration awards and modify or set them aside, if its action conforms to certain restrictions. Controversies which are dealt with in the fedeal courts are those which involve $3,000 or more and which pertain to interstate commerce.

It is probable that the existence of arbitration agreement will result, in most cases, in a settlement's being consummated without the aid of arbitrators or the action of the courts. If the dispute cannot be settled, however, arbitration is advantageous in many ways. It saves the cost of litigation, which greatly exceeds the cost of arbitration, and it effects a settlement in a shorter time. It is reasonable to assume that the results of arbitration will be more satisfactory than the decision of a judge or jury. The arbitrators will be men who know the trade situation and business practices pertinent to the dispute. They will be experts, capable of rendering a just and satisfactory decision without unudue loss of time. They will be such experts as would be brought into court to explain a situation to a jury. It will be a business men's court dealing with problems peculiar to a certain business. Such a group of men will be far more capable of satisfying the contestants than the ordinary jury, and the procedure will lack the objectionable aspects of taking the controversy to court. It is a businesslike, dignified procedure based on sound principles of equity and integrity.

The controversies which are most easily settled by arbitration are those pertaining to ordinary trade relations where established customs and practices are recognized. In such cases arbitrators, who are specialists in the problems involved, can get at the main issues very speedily and reach a decision based on precedent and generally accepted principles of equity. Of course, many contracts are unusual and of such nature that they do not so easily fit into a scheme of arbitration. Many and varied are the issues that may enter into the controversy. However, most leaders in the legal profession and prominent business men are sanctioning the theory of arbitration as a rational method of settling disputes.

One objection to arbitration in the past has been the fact that if the dispute could not be settled by arbitration, the matter ultimately reached the court. In that case, of course, it might as well have been taken there in the first place. In actual practice a large per cent of cases referred to arbitration have been settled satisfactorily. It has been etimated that 99 per cent of the arbitration awards

have been accepted by both parties without appeal to courts. The fact that court procedure is intricate and slow is winning many supporters for the arbitration method.

The next step in the development of the arbitration plan is state legislation. Uniform state laws are greatly needed and will undoubtedly be enacted soon. These laws should be in harmony with the federal law so that the contract that is valid between citizens of different states will also be valid between citizens of the same state. These state laws will cover intrastate transactions, but will also facilitate interstate transactions. New York and New Jersey already have statutes which are similar to the federal law. Massachusetts and Oregon have legislation dealing with arbitration but will undoubtedly improve upon it. Although most of the states have passed laws dealing with the problem of enforcing awards made by means of arbitration, they have no statutes enforcing agreements to settle disputes by arbitration. Laws in harmony with the new federal statute are not in existence as yet, but the functioning of the new federal law will no doubt result in the provision of the needed legislation.

Many business firms are looking into the subject of arbitration clauses to be included in their contracts. They are preparing to fall in line when the federal law goes into effect in January. Such contracts should be suitable for the line of business involved and should be drawn up with the aid of a lawyer. The following model clause has been suggested: "Any and all controversies arising under or out of or in connection with or relating to the agreement of which this is a part shall be submitted to arbitration, and judgment upon any award rendered may be entered in the highest court of the forum, state or federal, having jurisdiction in the premises."

Foresight in the matter of an arbitration bureau is also advisable. Plans for such tribunals in trade associations or in chambers of commerce, if the trade association refuses to act, should be formulated before the beginning of the year. Leaders of various groups are logical ones to study the situation and be ready when action is needed. As a matter of fact this is being done. Forward looking business men and prominent attorneys are studying the law and seeking information as to its possibilities in actual enforcement. No group can afford to ignore this legislation which promises to have a far reaching effect on business relations.

We recommend to all trade associations in the non-metallic industries that action be taken regarding this Federal Arbitration Act as early as possible, because the new act goes into effect on January 1, 1926, the law makes enforceable in federal courts the awards of arbitrators, uniform state arbitration laws will be sought in most states within the next year and many reputable concerns have already drafted arbitration clauses for inclusion in their contracts.

Announcing A Staff Addition

READERS of Pit and Quarry will be pleased to know that Mr. E. D. Roberts has joined our editorial staff as associate editor effective with this issue.

Mr. Roberts is a graduate engineer with thirteen years of practical experience in railroad construction, highway design and construction, municipal engineering, and cement mill design and construction. He is assistant professor of civil engineering at Marquette University. He was chief engineer for the Sun Portland Cement Company and designed and supervised construction of the new plant of this company at Lime, Oregon. An article on this plant by Mr. Roberts appeared in the July first number of Pit and Quarry.

At the present time Mr. Roberts is visiting some of the most interesting non-metallic operations in the country gathering data and material for publication in Pit and Quarry. The first of these articles dealing with the Manitowoc Portland Cement Company appears in this number.

E. D. ROBERTS

Hydraulic Features Important Factors in Modern Cement Plant Operation

Written Expressly for Pit and Quarry By E. D. Roberts*

CEMENT statistics disclosed the fact that Wisconsin's consumption of cement per capita was 1.68 barrels annually. The average for the entire United States was 1.06 barrels per capita. As there was no cement plant in Wisconsin, it seemed logical that a suitably located plant would be a success.

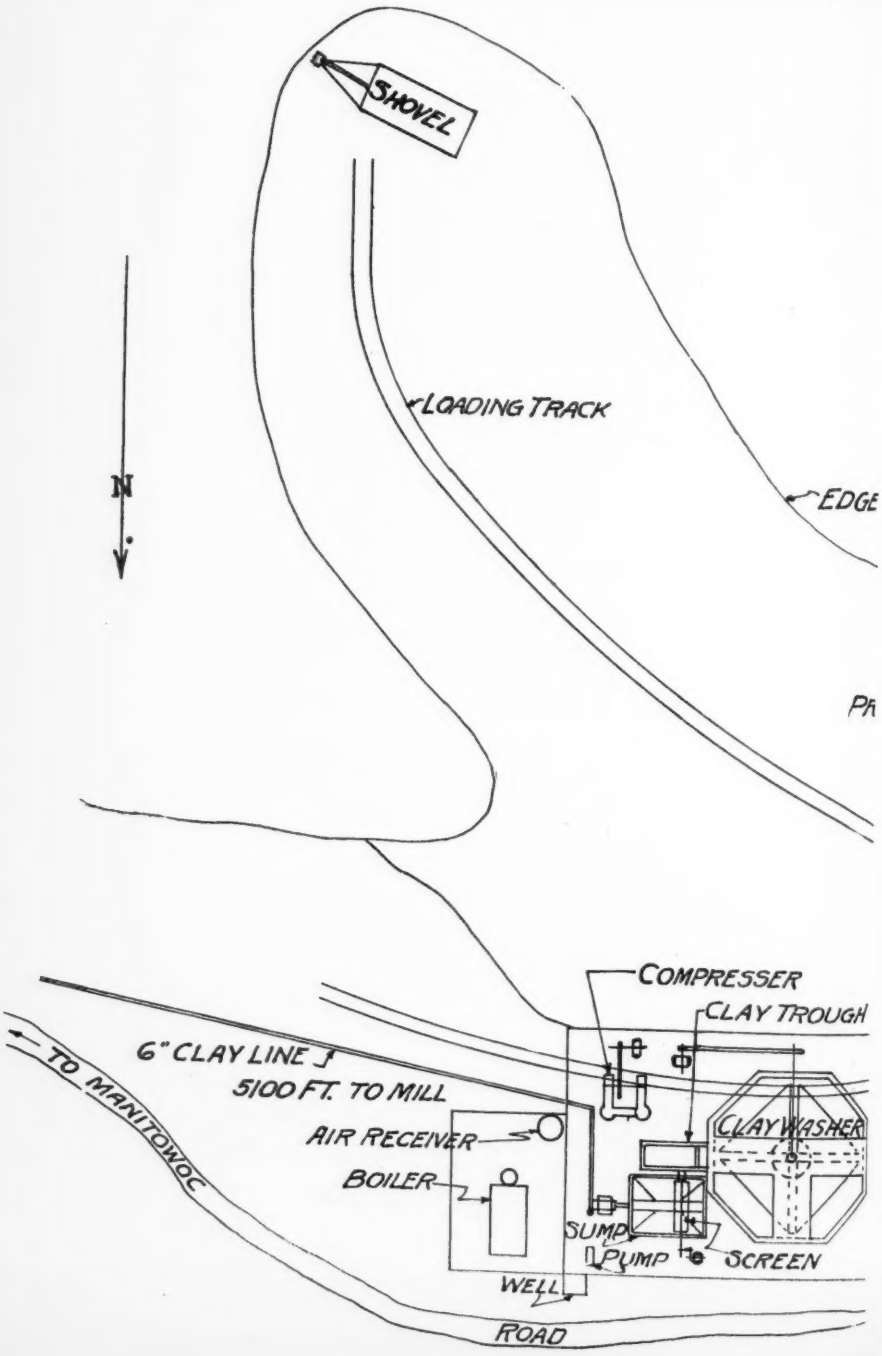
A survey of the available limestone deposits led to the conclusion that none existed in Wisconsin with a magnesium carbonate content low enough to make a desirable cement. However, an excellent stone could be secured at Rockport, Michigan, and transported by boat. This stone contained a large percentage of fines and dust which would reduce the work of the wet grinding mills. A suitable site along the Manitowoc River was available. The river could be dredged to permit the access of the large cargo boats which would need to be used to bring coal, rock and gypsum to the plant. The river would only need to be dredged to a depth of twenty-one feet to permit the largest type of lake freighter to dock. A large clay deposit with no overburden was also available, which with the addition of a small amount of sand was all that could be desired in a slurry.

Gypsum could be obtained from Michigan in cars. Ferries could transport these cars across the lake. Coal for burning could be secured by boat from lower lake ports. Manitowoc is the outlet for a large number of westbound empty cars. Normally 40 per cent of these cars are empty, thus assuring a good supply of cars at all times. With ideal harbor facilities Manitowoc provided cheap water transportation. The Soo line, the Chicago and Northwestern, the Ann Arbor and the Pere Marquette Railroads enabled shipments to be made to all points in Wisconsin and upper Michigan.

The foregoing conditions prompted

*Assistant Professor of Civil Engineering, Marquette University
Associate Editor, Pit and Quarry

An Airplane View of the Manitowoc Portland Cement Plant


SHOVEL
LOADING TRACK
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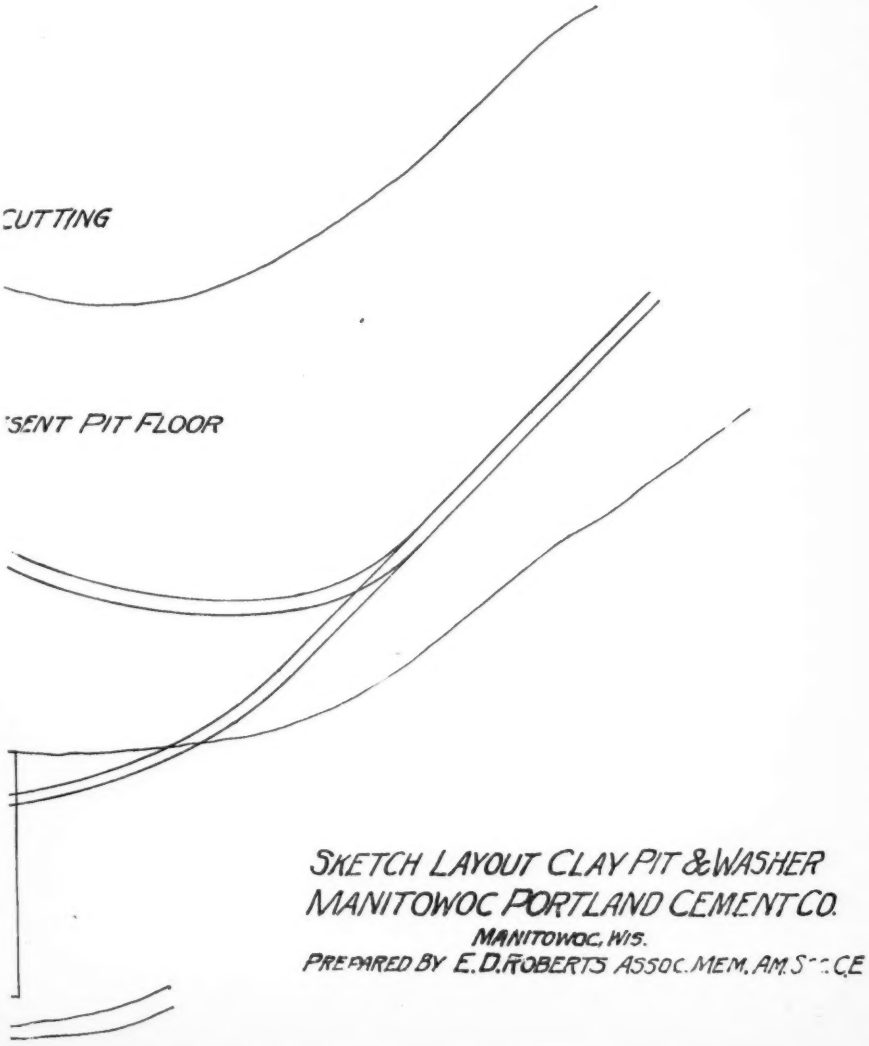
N
COMPRESSER
CLAY TROUGH
6" CLAY LINE
5100 FT. TO MILL
TO MANITOWOC
AIR RECEIVER
BOILER
CLAY WASHER
SUMP
PUMP
SCREEN
WELL
ROAD

the officials of the present Manitowoc Portland Cement Company to build a cement plant at Manitowoc, Wisconsin. Men with large experience in the construction and operation of successful cement plants were soon associated with the enterprise.

Actual construction on the plant was started in September, 1923. Eight months later on May 15th, 1924, the plant began operation. This was a record for cement plant construction and an enviable one, when the severe winters of this section of Wisconsin are considered. In discussing the operation of the plant the flow of materials will be traced by following the usual order of manufacture.

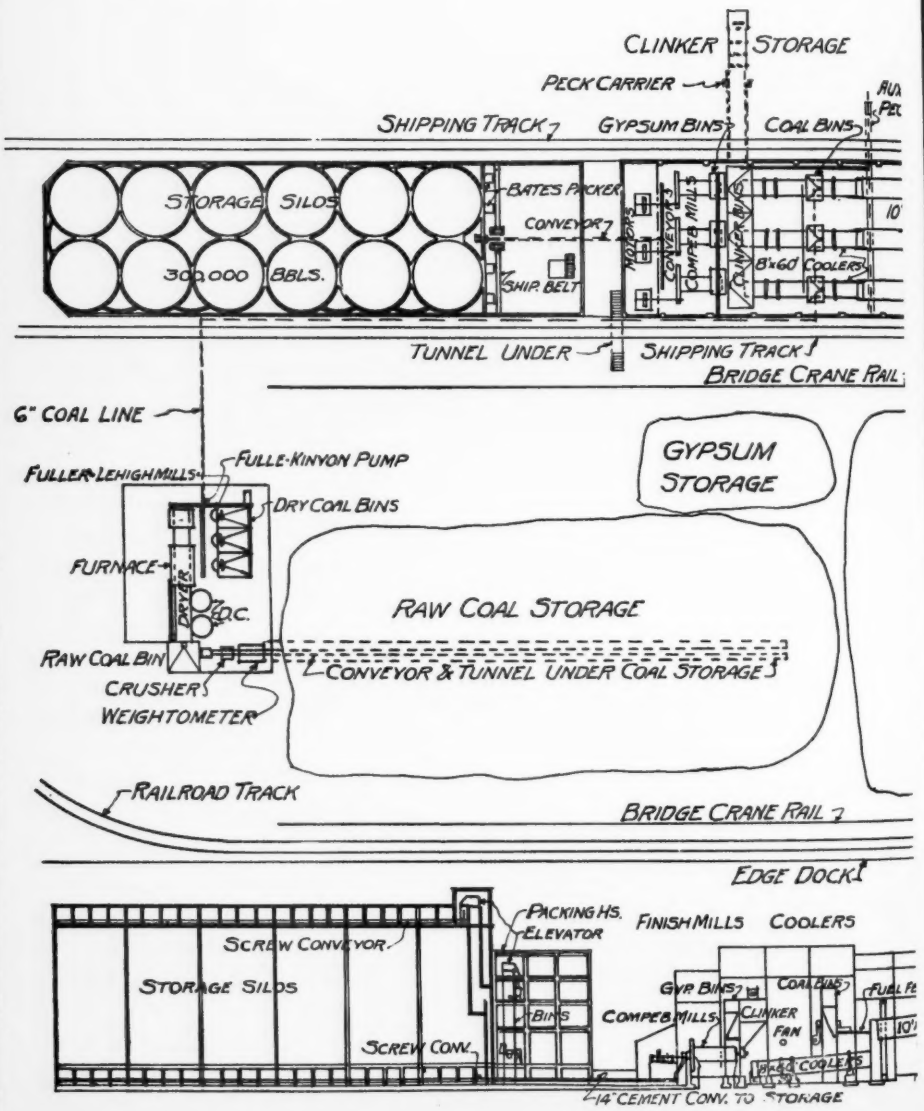
Loading and Handling Bridge

As Lake Michigan is closed to boats for about four months of the year, it was necessary to provide storage enough for coal, gypsum, and lime rock to keep the plant in operation during this time and longer if neces-


CUTTING
SENT PIT FLOOR
SKETCH LAYOUT CLAY PIT & WASHER
MANITOWOC PORTLAND CEMENT CO.
MANITOWOC, WIS.
PREPARED BY E. D. ROBERTS ASSOC. MEM. AM. SOC. CE

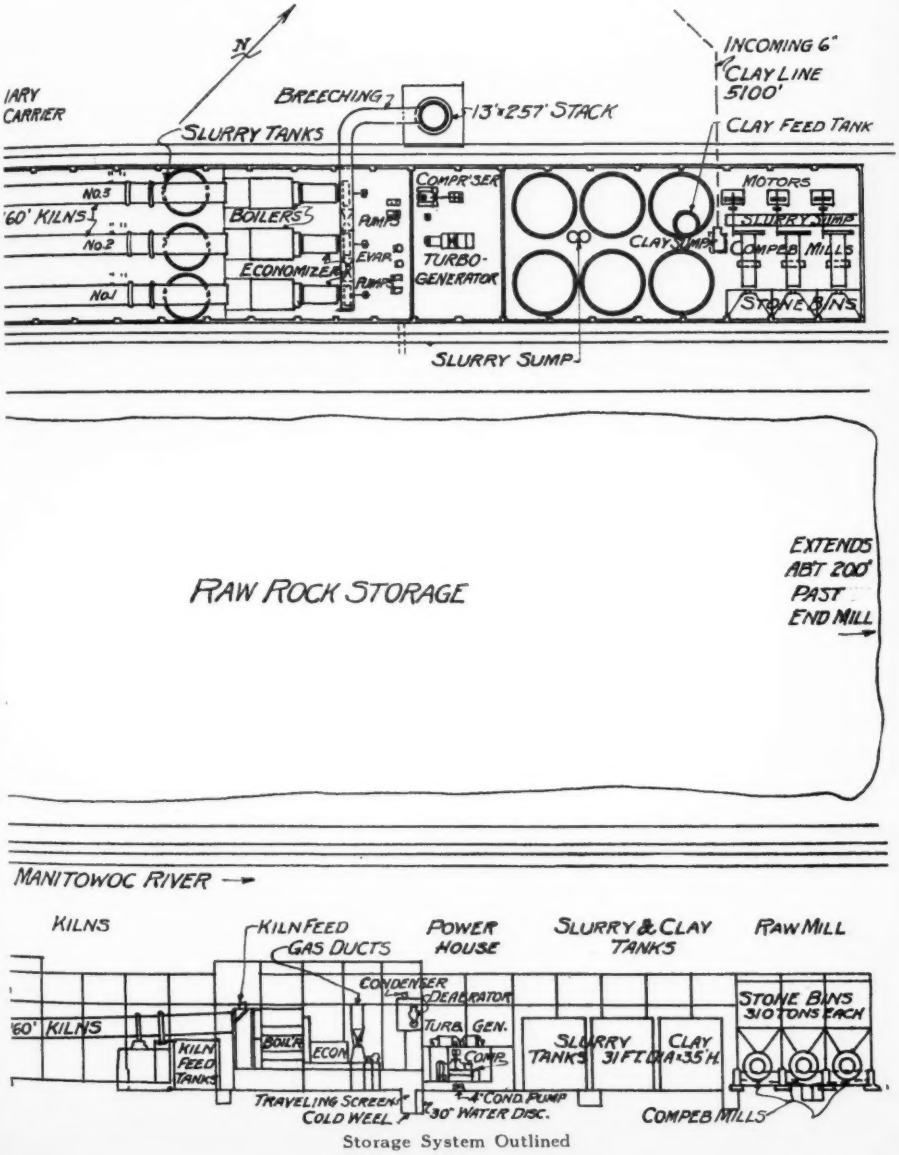
sary. Accordingly, an unloading and handling bridge was designed with a clear span of 234 feet clearing piles of material 50 feet in height and operating on a track 1,000 feet long, with a capacity for handling 300 tons of materials per hour. The storage space will accommodate 250,000 tons of rock and 75,000 tons of coal, or more than ample quantity to tide over the plant when turning out 3,600 barrels of cement per day during the period when navigation is closed.

This bridge is a Mead-Morrison bridge crane operating a 4½ yard clam shell bucket that picks the ma-



Plan and Elevation With

terial from the hold of the ship and drops it on the storage pile or directly into a 40 ton bin at the plant end from which it is elevated by a bucket conveyor to a hopper at the elevation of the bridge floor. A spout from this hopper directs it into the steel storage bins over the grinding mills. Gypsum is easily unloaded from flat bottom gondolas by the clam shell and stored in the pile or dropped into the above mentioned hopper and elevated in the same manner as the stone. It is spouted into a hopper, however, that feeds the gypsum into a screw conveyor that distributes it



Storage System Outlined

to any one of three bins situated over the finish grind mills. Coal is unloaded onto a pile over a belt conveyor operating under the dock. If fires are noted in the coal, the crane picks out the burning coal and deposits it in an open space, then dips water from the Manitowoc River and puts it out.

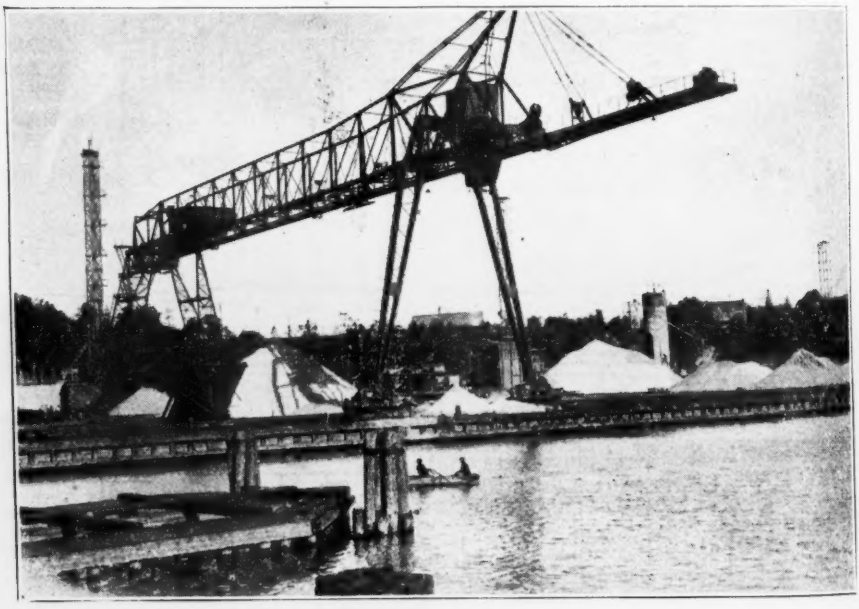
Direct current electricity is used as power to operate the machinery. The operation of the bridge has been found to be very satisfactory due to the provision of ample storage bins; for the material handled is easily able to keep the entire plant in continuous operation.

Mining and Pumping Clay

The clay mine or deposit lies in a bank along the Manitowoc River about one mile above the chosen mill site. About 50 acres were secured by the company having a face of 80 feet and without any overburden. In case heavy sod is encountered, it is stripped; otherwise no stripping is required. The upper 40 feet of this deposit is now being mined in such a way that loaded cars transport it by gravity to the clay washer built at the face of the deposit. The clay is loaded into 1½ yard side dump cars by an electrically operated ¾ yard Thew caterpillar shovel. A Fordson on 36 inch gauge driving wheels pushes the empty cars up to the shovel for loading and returns to draw another set of cars to clear the switch and wait for the loaded cars to pass them. This keeps the shovel and the washer crew working nearly continuously with a minimum of switching and power.

From the cars the clay falls into an Allis Chalmers wash mill that mixes water with the clay and breaks it up into small particles. Enough water is introduced to furnish a greater part of the water required for a proper slurry, and to give a fluid that will transport easily to the mill. 55 per cent water and 45 per cent clay is about the usual proportion. The wash mill is of hexagonal reinforced concrete construction lined with paving brick in which paddles braced with chains are rapidly revolved keeping the contents in a turbulent state.

From the washer it is drawn off into a sump through a revolving screen that eliminates all particles that have not been reduced to the proper fineness. A 4 inch Wilfley centrifugal pump discharges the screened material into a 6 inch line 5,300 feet long that conveys it to the



The Bridge Crane Before Plant Was Completed

clay storage tanks in the wet mill. Compresed air is introduced into the 6 inch line to lighten the load and reduce friction in the pipe line and thereby increase its efficiency. The clay line has been located below frost except where it crosses the Manitowoc River on the railroad bridge where it is covered to keep the contents from freezing. Drains have been provided in the line at all low places for emergency use. The clay is not pumped continuously, and at the end of each load the line is cleaned out. A signal at the wet mill announces to the operator that water is coming to clean out the line, and he turns the water into a sump from where it is pumped into the river.

Steam is introduced into the washer during the cold weather; this is furnished by a boiler at the clay mill. All power is furnished by a 2300 volt transmission line from the main plant. An outside transformer at the clay mill steps it down to 440 for use. The clay plant has given no trouble in operation, and with the exception of a small amount of blasting of the clay during extremely cold weather, it operates continuously, as stated, with one 10 hour shift furnishing enough material for a day's run of the cement plant.

There are two circular reinforced concrete clay storage tanks 31 feet inside diameter and 34½ feet in height with a combined capacity sufficient for 12,500 barrels of cement. A 3 inch Morris manganese steel pump handles the clay into a small tank over the two main tanks. This tank is equipped with an overflow so that a constant head is maintained on the feed line to the three mill feeds where it is fed through a nipple into the raw rock as it emerges from the rock feeder.

The raw rock is fed into the mills by a rocker arm from steel hoppered bins of 370 tons capacity each built directly over the feed end of the mills. The mills are Allis Chalmers Number 722, 7 x 22 feet, compeb mills. Each mill does the complete grinding in two states, the power for which is furnished by a 400 H. P. 2300 volt 60 cycle Allis Chalmers synchronous motor through 60 inch Cutler Hammer magnetic clutches. Excitation is furnished for operating the clutches and motors by a 60 kilowatts exciter set.

The slurry from the three mills falls into a common sump and is pumped into any one of four slurry tanks located beside the clay tanks and of the same capacity and construction. Another Allis Chalmers slurry pump is located between the four tanks with piping so arranged that slurry can be pumped from any tank to any other tank for correction purposes or to the 3 kiln feed tanks, one located under each kiln. The kiln feed tanks have a capacity of 1,000 barrels of cement each and are of circular reinforced concrete construction with a diameter of 22 feet inside and 23 feet deep.

An 18 x 24 Ingersoll Rand air compressor furnishes the air required for the operation of these slurry and clay pumps and for air agitation of the clay and slurry while in the tanks. Another slurry pump lifts the slurry

View of Clay Pit

into the kiln feed trough at the upper end of the kilns where it is kept agitated by moving paddles. The slurry is fed into the kilns by a Ferris wheel bucket feeder for each kiln operated independently by a two speed squirrel cage motor connected in parallel with a similar motor that operates that particular kiln. This insures synchronous operation of kiln feed and kiln.

Kiln Operation

There are three kilns each 10 feet in diameter and 160 feet long resting on two trunion bearings and operated by a 50 H. P. two speed motor through a Link Belt chain drive. Sil-O-Cel insulation is used in the kilns with the exception of a few feet at each end. The two speed motor for kiln operation has been found to give generally increased production. The kiln either is in low or high. The operator will increase the fuel feed rather than go into low. It requires closer observation of the fuel end on the part of the operator but gives increased output in the long run.

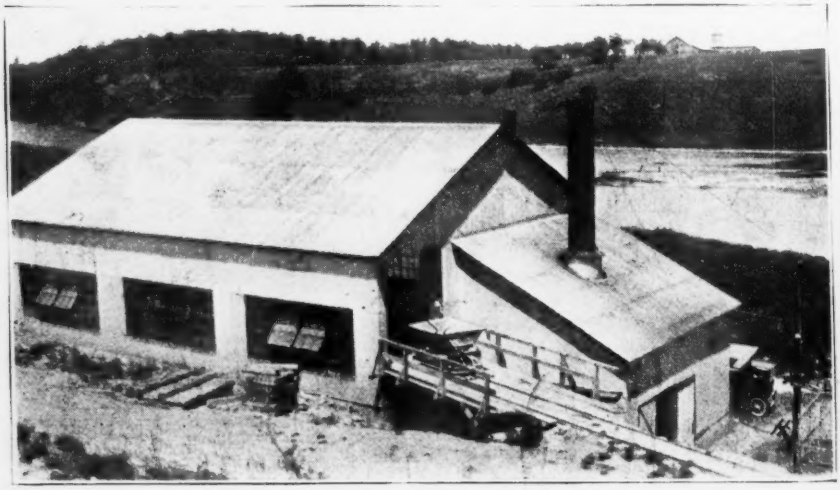
The burned clinker discharges directly into an 8 x 60 feet cooler lined with paving brick for the first 40 feet and operated by a 20 H. P. squirrel cage induction motor. The cooled clinker can be picked up by hand. Both the kilns and cooler were manufactured by the Manitowoc Engineering Works.

A 24 x 24 Link Belt Peck carrier passing under the discharge of each cooler conveys the clinker to the storage pile or up into the clinker bins. These bins are of 1,000 barrels capacity each and are located directly over the feed to the finish grind mills. Very little clinker is stored outside as plenty of cement storage has been provided to carry over the slack periods. An auxiliary Peck carrier has been installed under the discharge from the kiln so as to by pass the cooler if necessary. A spout from a high point on this run chutes the clinker into the main Peck carrier. If necessary, it may be deposited in outside storage.

The fuel for burning the clinker is powdered coal fed to the kilns from the coal storage tanks by feeders of the company's own design and construction. Screw feeders under each tank introduce the coal into two 8 inch air pipes that shoot it into the kiln. Air for this operation is provided by two Bayley fans discharging into a common header leading to each feeder. The fans are of such capacity that the kilns may be kept in operation by one fan.

Finish Grinding

Individual 30 ton steel bins containing gypsum are located above each of the three Number 722 compeb mills and adjacent to the clinker bins. A screw feed, operated by an adjustable gear connected to the drive for the rocker arm feed under the clinker bins, mixes the proper amount of gyp-



The Clay Wash Mill

sum and clinker and introduces the mix into the feed end of the mill. These mills are of the same type as the wet mills and complete the grinding in two stages in the same mill.

A 14 inch cross screw conveyor under the discharge end of the mills conveys the cement to another 14 inch screw that conveys the cement to the elevators to the top of the storage silos. An electrically operated control releases the magnetic clutches on the mill and stops them in case anything should cause a stoppage of the elevators or conveyors to the storage. This eliminates danger of plug ups.

Storage and Packing

The silos are of reinforced concrete construction each 36 feet inside diameter and 80 feet high. There are 12 bins in all which together with the interstice bins provide storage for a little over 300,000 barrels of cement. The MacDonald Engineering Company constructed the silos together with the reinforced concrete packing house which is connected onto one end of the silos.

The packing house has four floors and a basement and covers 50 feet by 78 feet of area. The top floor is the sack cleaning room where the returned sacks are cleaned, repaired and chuted to the floor below where they are tied and stored for use. Storage is also provided on the floor above the packing floor. Chutes conduct the sacks from any floor to the packers' platform. An electrically operated freight elevator serves all floors of this building greatly adding to the efficiency of the plant and men operating this end of it.

The cement is drawn from the silos by 4 longitudinal conveyors, two under each row of silos. They are arranged to tap the interstice bins as well. A cross conveyor drops the cement into an elevator that elevates it to the top floor of the packing house where it passes through a screen into a distributing screw that operates over the bins feeding the packers. There are two 3 sack Bates packers on each side of the building arranged in pairs. Each pair has its own screen and belt conveyor for handling the sacked cement into the cars. Shipping tracks are located on each side of the building with a 14 car capacity for each track past the shipping belt. A Mead Morrison electric car puller serves each track to expedite the spotting of cars during loading.

A Sly dust collecting system installed at the packers reclaims the

View of Storage Silos and Packing House

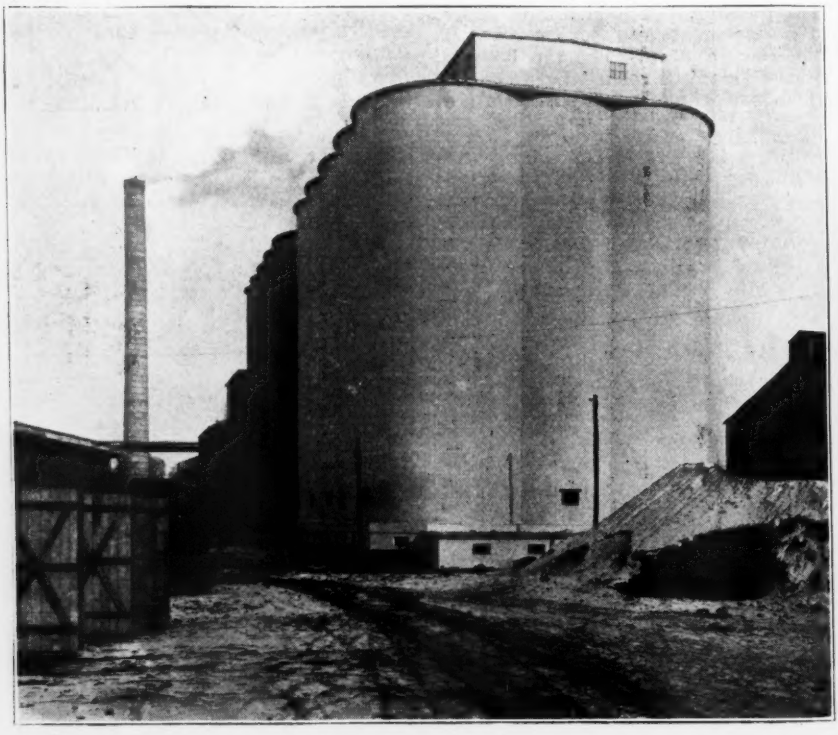
cement dust and eliminates the dust nuisance. Provision has been made for conveying the freshly ground cement to a silo to be erected at the water's edge where a packer will be installed for marine shipping. Link Belt conveyors and elevators have been used throughout the plant.

Coal Grinding

At the west end of the bridge craneway a structural steel mill building has been erected between the river and the south shipping track. This houses the coal pulverizing plant.

The outside coal storage deposited by the bridge when unloading boats is over a reinforced concrete tunnel 225 feet long. Trap doors have been provided in the roof of this tunnel which, when opened, will drop the coal directly onto a 30 inch belt conveyor, manufactured by the Stevens Adamson Company. This conveyor carries the coal over an automatic Merrick weightometer fitted with a Magnetic Manufacturing Company magnetic pulley to eliminate all tramp iron. After receiving a preliminary breaking in a Pennsylvania roll crusher it is elevated to a bin over the dryer. In case of trouble with the crusher or if coal screenings are obtained, the roll crusher may be bypassed.

From the moist coal bins the coal is fed into the dryer by an Allis Chalmers rocker arm feeder. The dryer was manufactured by the Manitowoc Engineering Works and is of their own design. A 6 x 60 foot cylinder is fitted with lifters and set on a grade which when rotated at the proper speed, forces the coal to travel throughout its length. The fire is applied directly to the shell of the cylinder at its center. Afterwards the hot gases are led through a passageway to the discharge end of the dryer and then traverse its length directly on the coal. An exhauster discharging through a two stage dust collector provides the draft for operating the dryer. In case of a shut down an auxiliary stack discharges the hot gases directly to the outside air. A conveyor and elevator discharge the



View of Storage Silos

dried coal into a large steel bin of 100 tons, capacity with three hoppers. Each hopper is directly over a Fuller-Lehigh coal mill. These mills are 42 inches and are driven by 75 H. P. vertical motors.

The Fuller mills discharge directly into a feed screw that leads to a Fuller-Kinyon coal pump. The coal is pumped through a 6 inch pipe line to bins directly over the kiln feeders in the kiln room. Automatic electric control provides for diverting feed from one bin to another in case a bin fills or for shutting down the mills in case they get ahead of the kilns.

A very noticeable thing about the coal pulverizing building is its cleanliness. In fact this is noticeable throughout the plant. No clothes protectors are furnished and none are needed.

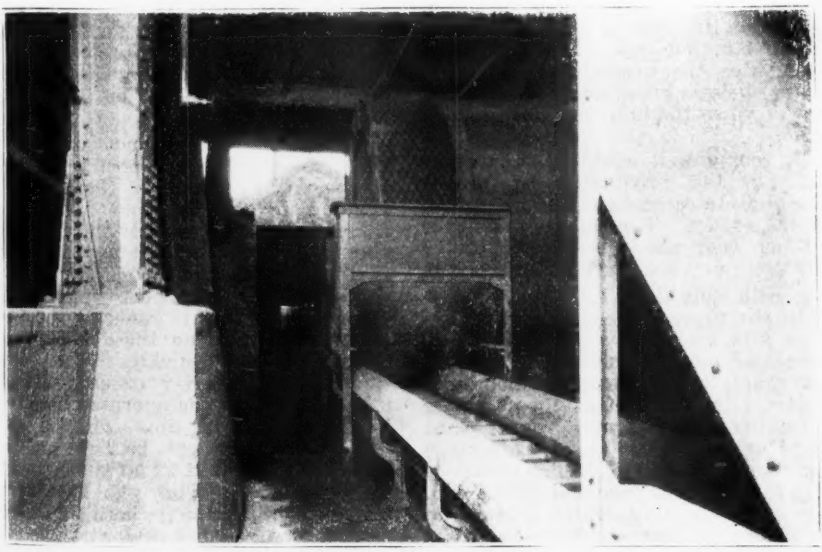
Very few belts have been used throughout the plant. Speed reduction is obtained by Link Belt silent chain drive or Cleveland worm gears wherever possible.

Power Supply

Between the feed end of the kilns and the raw grinding department we find the power plant. Waste heat from the kilns is here utilized to furnish all power required to operate the plant. The waste gases from each kiln are discharged into a 750 H. P. Rust boiler with three passes. Further efficiency is obtained with a B. & W. superheater, a B. F. Sturtevant economizer and a Sturtevant induced draft fan for each unit. The fans are operated by 100 H.P. variable speed motors. The discharge from the fans passes into a common breeching and out through a passageway and up a 14 x 257 reinforced concrete stack.

Provision is made in each passageway for the flue dust to gravitate to hoppers placed underneath the passageways. Conveyors pick up this dust and carry it to an elevator that drops it into a pug mill where it is mixed with about 35 per cent of water and then introduced into the slurry. About 60 barrels or 90 per cent of the cement dust is recovered a day in this way, which in a year's time will show an enormous saving. The many passageways through the waste heat recovery plant are largely responsible for this opportunity to recover the waste clinker dust. This also minimizes the dust nuisance which in a town might cause a shut down of the plant. All in all the installation of the waste heat recovery is a very profitable installation.

The turbine room is located just east of the boiler room. A 3125 KVA 2300 V 60 cycle Allis Chalmers turbo generator set operating with a sur-



Cooler Feeding Hot Clinker Into 24x24 Inch Carrier

face condenser is the main equipment used. Excitation for the main generator is provided by a 60 KW generator set. Direct current for operation of the bridge crane is provided by a 300 KW motor generator set.

Automatic and recording devices notify the operator of any change in the power units of the plant. Three Brown duplex recording pyrometers record the temperatures of the gases entering and leaving each boiler. Bailey fluid meters record the steam temperature and flow from each boiler. Another Bailey meter records the flow of steam to the turbine while another records the flow of feed water entering and leaving the feed water heater together with its temperature. Brown indicating pyrometers show the temperature of the gas in each passage of the waste heat boilers.

Two Number 24 Reiley evaporators, a condenser and a de-aerator furnished by the Griscom-Russell Company are installed to furnish the proper water to the boilers. Ordinarily the fuel for their operation is some of the waste heat from the boilers. The steam from the turbine is condensed and de-aerated and returned to the boiler feed. Fresh river water is condensed to add to the reused steam. This provides distilled water for boiler operation.

The plant is connected with the feed lines of the local electric power company to furnish power for plant operation in case of shut downs or when starting up. This provision eliminates the necessity of an auxiliary boiler installation to furnish power when the kilns are not in operation.

A roomy well equipped laboratory aids in the production by proper sampling to control the mix and prove their product. The cement tests over 50 per cent above requirements for the seven day test for tensile strength.

The Kiln Ring Gun

In the process of cement manufacture kiln rings have always been a source of much trouble. These rings are simply heavy coatings which build up from the sides of a kiln in a ring formation. In the wet process plant at Manitowoc two kinds of rings form: one a mud ring which occasionally forms in the feed end of the kiln, the other a ring which builds up about 30 feet from the burning end of the kiln. The Manitowoc Portland Cement Company has solved the problem saving shutdowns and the labor used by the old methods.

They are using a specially designed kiln gun, manufactured by the Remington Arms Company, to break out these rings. While it is true that various guns have been used in the past, they have had their disadvantages. Guns with heavy slugs, high powered rifles, and even machine guns have been experimented with, but with little success. The high powered rifle and the machine gun created a hazard from the bullets. A bullet from a high powered rifle will penetrate the kiln ring, but it will also penetrate a boiler plate when the ring is missed. The new Remington gun is the result of experiments covering a period of two years. This gun shoots a slug which does not penetrate the kiln ring deeply but depends upon its effectiveness through the jar it creates which is transmitted over a large surface area.

The gun is of the bolt action type with a one inch bore and is of heavy construction. It is mounted on a platform which is adjustable for alignment and elevation. It has a recoil absorbing spring. Each kiln front is equipped with an I beam on the hood for the gun platform. The gun can be set in position in a few seconds. It is fired through the opening in the hood. A 3 ounce single slug is fired with a substantial charge of powder. On the average about 225 shots will cut a section out of the ring large enough to cause it to break up and fall out when the kiln is revolved. About 20 shots can be fired per minute.

When the gun is set up, it is quickly sighted on a portion of the ring close to the shell of the kiln. By rapid firing a hole is cut through in three or four minutes with about 50 shots. If the ring is heavy, the gun is directed to the opposite side of the ring and the performance repeated. The ring is generally broken by concentrating on these two opposite ends very quickly. The total time involved rarely exceeds fifteen minutes, and as the operator becomes experienced, this time will be cut down. The gun can be held on the line sighted as it is at all times under perfect control. This gun has saved this cement company both in labor and in time as compared with the old method used by many cement companies.

The Manitowoc Engineering Works fabricated and erected the steel mill buildings housing all of the plant with the exception of the packing house and storage silos which were erected by the MacDonald Engineering Corporation. All steel bins, hoppers, kilns, coolers, and coal dryer together with various and sundry other things were manufactured and placed by the same Manitowoc Company. This aided in a large degree in securing a construction record for a plant of this size.

The officials of the company should be given credit for designing and erecting one of the most efficient cement plants in operation. Foresight, study and experience are shown in every phase of it. Proper allowance for clearances have been provided to give safety and ease of operation and rapid intercommunication between the various parts. Safety first is stressed at all times. A good example of this is shown by the fact that a reinforced concrete tunnel has been provided for the employees to pass under the loading tracks.

The officers of the company are Charles C. West, President; J. B. John, Vice President and General Manager; H. Vanderwerp, Assistant General Manager; L. E. Geer, Secretary and Treasurer; J. E. Thiell, Assistant Treasurer; F. E. Town, Superintendent; and R. E. Minogue, Assistant Superintendent. E. B. Nichols is Chief Engineer; P. G. Dawson, Assistant Secretary; G. P. Schwaab, Sales Manager; W. H. McReynolds, Traffic Manager; and H. A. Meyer, Purchasing Agent. Mr. West, President, is also president of the Manitowoc Engineering Works and the Manitowoc Shipbuilding Corporation. Mr. John is connected with several other cement companies in an official capacity, and his previous experience shows in the design of this plant. Mr. Vanderwerp is in charge of the plant. The Manitowoc Portland Cement Company markets its product under the name of the Badger State Portland Cement.

Magnetic Pulleys

In those plants where no magnetic High Duty Pulleys are in use, the superintendents and foremen are often confronted by such problems as the following described in the latest bulletin of the Magnetic Manufacturing Co., of Milwaukee:

"Crash! . . . the scream of smashing metal . . . a final roar . . . then silence. All the machinery stops. You rush out to see what's wrong and find the foreman, profane and disgusted, surveying a wrecked machine. 'Another chunck of that d—n tramp iron. Ruined our crusher. Nothing to do but shut down the plant until we get her fixed. And that'll cost you ten times the price of the magnetic pulley I've been asking you to buy.' "

The illustrations, which are in several colors, show how the principle works. They show how the material including various pieces of 'tramp iron,' rides down the conveyor belt toward the crushers. When the iron reaches the magnetic pulley at the end of the conveyor, they are drawn tightly to the belt by the magnetic force until they reach the under side of the conveyor, and on leaving proximity to the magnetic pulley, drop harmlessly upon a platform beneath.

The cost of these pulleys, in spite of their highly specialized character, is not correspondingly high. In fact, it is said to be unimportant,—"they are the lowest priced machines in the magnetic separator field!"

The bulletin lists the names of a number of large and important concerns that use Ventilated High Duty Magnetic Pulleys including the Carnegie Steel Company, Youngstown Sheet and Tube Company, United States Gypsum Company, General Electric Company, Dittlinger Lime Company, and the New York Trap Rock Company.

Highway Research Meeting

At a recent meeting of the Executive Committe of the Highway Research Board of the National Research Council it was decided to hold the fifth annual meeting of the Board at Washington, D. C., on December 3rd and 4th, 1925. Progress reports received from the Chairman of the Research Committees showed that they are conducting important studies on almost every phase of highway development, including finance, design, construction and maintenance, thus assuring a successful annual meeting. The program for the fifth annual meeting is now being prepared and will soon be announced.

Some Unusual Manganese Steel Products

Figure 1 shows the longest, strongest and heaviest rolled manganese steel flat link dredge chain ever made. This chain is over 400 feet long, single strand with 24 inch pitch and weighs 4½ tons. The center links are 1½ inches thick, 4 inches wide, 30 inches long with 1⅛ inch round pin holes. The side links are ¾ inch thick, 4 inches wide, 30 inches long with 1⅛ inch keyed pin holes.

This chain is made from "Rol-man" manganese steel rolled bars having a tensile strength of 150,000 pounds per square inch and a shearing strength of 100,000 pounds per square inch. The steel is heat treated, and all holes were punched from the solid bar to gauge, giving extreme accuracy of pitch and diameter, shape, size and location of all holes. This chain was manufactured by the Manganese Steel Forge Company of Philadephia for one of the large river dredges in operation on the Ohio River in the Pittsburgh district.

Figure 2 shows a Rol-man manganese steel welded pontoon dredge pipe in 20 foot sections. This pipe is made up of 4 sheets, 5 feet long, of Rol-man rolled manganese steel plates, 5/32 of an inch thick, rolled to a full circle and welded.

The outside horizontal and circular seams are strapped with soft steel as they are not subject to wear. All seams and joints are electrically welded. The ends are fitted with 1½ x ⅜ inch half oval band iron for securing the sections together, with rubber sleeves clamped on.

This pipe was made for one of the largest hydraulic sand and gravel pumping operations in the Delaware River district of Eastern Pennsylvania by the Manganese Steel Forge Company of Philadelphia.

New Edelblute Factory

The T. H. Edelblute Company has recently built a new and enlarged factory at Reynoldsville, Pennsylvania, to take care of the wide and growing demand for their main product, the "Anchor" Rerailer. The Reynoldsville works will be managed by N. G. Edelblute, and the general sales office will be continued as before at Pittsburgh in the Wabash Building.

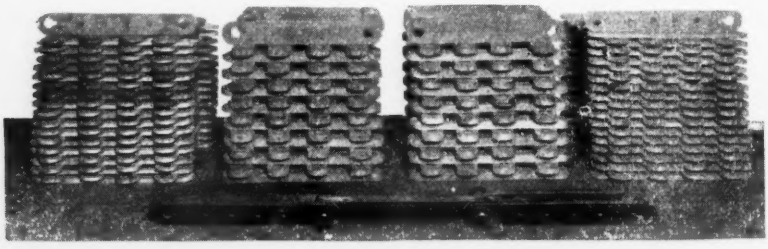


Figure 1

Figure 2

Pumping Problems in the Cement Industry

Written Expressly for Pit a nd Quarry by C. H. Sonntag

CEMENT manufacture in its present state of development is one of those industries that demand of all mechanical equipment continuous performance for twenty-four hours a day and seven days in the week. This is the ideal, so far unattained, that every mill man looks forward to, and the wise buyer of machinery will have steady operation in mind as well as first cost. Cement makers are, like other manufacturers, coming more and more to learn that when production is curtailed by shut-downs, most of the pay-roll goes on just the same; a repair bill on the disabled machine is in order; and the profit that should have accrued on the output that was lost does not materialize.

In dry process mills pumps are numbered among the machines that are not directly concerned in the manufacturing process, but which nevertheless must function steadily if the mill is to keep on running. They will be found doing their principal work in the power house, feeding boilers and supplying service water for general plant use.

Boiler Feeding

The "old reliable" reciprocating steam pump has been standard in this service for years. The cheapest style is the packed piston type, in which the water piston slides in a brass sleeve and carries its own packing. For low pressures this design will do very well, but it should not be used against the higher pressures found in modern boiler houses. The packing will fail in time and leak, but there will be no visible evidence of this. It must be guessed at by the speed of the pump or its irregular operation. If the packing is so arranged that leakage will be external, it will get better attention, and the pump is apt to be kept more nearly ship-shape. This condition is embodied in the plunger-type pumps, which are known as outside center packed and outside end packed.

In the former each cylinder is in two single-acting parts, between which the plunger moves. The packing is between the parts of the cylinder, and the piston rod must also enter one end of the cylinder, making four plunger and two rod packings to be cared for in a duplex pump. The center packing is rather inaccessible; the water cylinders are quite complicated castings, and may be made up of several pieces with packed joints liable to leakage. The plungers are hollow and supposed to have some buoyancy, but they are apt to be porous and fill with water, and the entire weight must be carried on the packing, as there is no way of arranging an external guide or support.

An example of an outside end packed pump is shown in Figure 1 (a). Each water cylinder has a solid transverse partition in the middle, so that there are really four single-acting cylinders and four plungers. These latter only need to be packed, as the piston rod does not enter the water end. The glands are easily accessible for tightening or repacking. In large pumps the weight of the plunger farthest from the steam end may be carried on a slipper or cross-head guide that may be bolted to that end of the cylinder.

This illustration also shows two other valuable features. The steam and water ends are tied together by steel rods instead of the cast iron connections used until recently. The tension in these rods may become quite high, and they are not liable to fracture as is cast iron. The valve chambers shown are of the pot-valve type, and this feature should be included in every high pressure reciprocating pump. It makes it possible to get at every valve separately, and the gaskets under the chamber covers are comparatively small and easily kept tight. In cheaper designs the valves are arranged in decks like those of packed piston pumps. The gaskets of the access openings and around the decks are large and liable to failure, and if the cast iron cover is large the breathing action induced by the pulsations of pressure may crack it.

For the piston rods in the steam end any good metallic packing will give better results than fibrous organic material. The only particular requirement is that the rods shall be round and of uniform diameter. For the plungers one of the so-called diagonal packings should be used, as the pressure helps to tighten it, and it is not

necessary to screw up the gland followers so snugly.

In boiler plants of 150 H.P. or above the centrifugal feed pump will give good service. Two stages at least, and perhaps three will be needed to feed against the pressures now in use. Such a machine is shown in Figure 2 (b). The pump may be driven by a motor, in which case it will be dependent on the main generating units for its power, or it may be driven by a direct-connected steam turbine, when it will be independent of the electrical supply and can be used at any time. Most engineers will wish to install at least one of each type as insurance against break-down.

For every centrifugal pump run at constant speed there is a definite relation between the volume of water being handled at any instant and the pressure at which this volume may be discharged. In commercial pumps the pressure rises as the volume passed is reduced by throttling. The ratio of pressure to quantity is determined by the design of the impeller, and when plotted as a curve is known as its characteristic. In pumps intended for boiler feeding the design is such that the discharge pressure can not rise excessively when the flow is throttled or even shut off altogether.

If the pump is motor-driven, it will probably run at constant speed, and

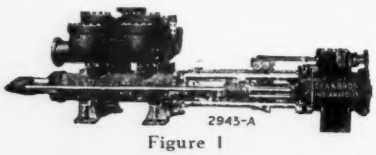


Figure 1

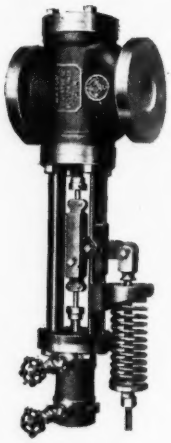


Figure 3

the natural characteristic of the impeller will be depended upon to prevent the building up of excessive pressure. If steam-driven it is best controlled by a constant excess pressure governor, one type of which is shown in Figure 3 (c). Such a regulator maintains the feed water at a fixed pressure above that in the boiler, regardless of the fluctuations of the latter, and as a result a given opening of the feed valve always means a certain fixed rate of feed. This is of particular value when automatic feed regulators are used, for assuming a constant boiler load and constant rate of feed, if the boiler pressure is much higher than the steam pressure, the regulator will keep its valve nearly closed, and in so doing will carry a high water level. On the other hand,

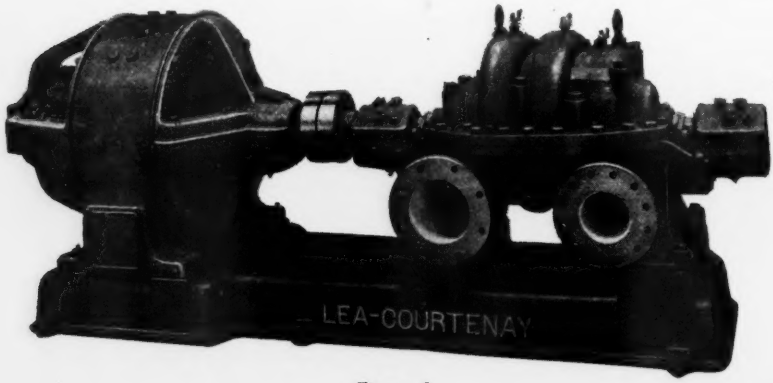


Figure 2

if there is not much difference between feed and boiler pressures, the regulator will compensate for this by keeping its valve wider open, and to do this must carry a low water level in the boiler. The constant excess pressure governor is also an excellent control for the reciprocating feed pump.

A reciprocating pump may occasionally, due to failure of its governor or the closing of all feed valves, build up a very high pressure,—much higher than is needed or desired. The exact value will depend on the ratio of the areas of the steam and water pistons. The centrifugal pump will be limited in speed by its motor if so driven, or by the speed governor of its steam turbine, if that is its source of power. If the pump is properly chosen for boiler feeding purposes, it will not under constant speed build up a dangerous pressure, and the discharge may be entirely closed off for a few minutes without serious results. If run this way too long the water in the pump will probably boil because of the energy used in overcoming its internal friction.

General Service

The water for general plant use, commonly known as service water, may be furnished by either reciprocating or centrifugal pumps. The pressure is moderate, 75 pounds being a satisfactory figure. Steam pumps for such service are made with the water cylinders of larger bore than the steam cylinders, and are known as tank pumps. They will handle low-pressure water with less steam than those of conventional design. Due to the relation between the cylinder bores they can not build up a water pressure as high as that of the steam.

The centrifugal service pump may be either motor or steam driven, and a single stage machine will be satisfactory. This pump will almost certainly be required to handle much more water than the feed pumps, and in some power-house arrangements the service pump supplies the feed-water heater in addition to its other duties, so that this should be borne in mind in deciding on its size.

A motor-driven single stage machine is shown in Figure 4 (d) with the water chamber cover and bearing caps raised. This is done to show the complete accessibility of the interior without lifting the shaft, this being a feature of all high grade centrifugal pumps. It will be noted also that the packing glands are entirely separate from the bearings, so that water leaking past them can not mix with the oil. The shaft should be covered with a bronze wearing sleeve where it passes through the packing. One of the bearings is designed to take care of any end thrust that may develop, but the double suction single stage pump is intrinsically hydraulically balanced, and no end thrust should exist unless one of the suction openings of the impeller should become obstructed by solid matter. In multi-stage machines the various manufacturers have made use of a variety of

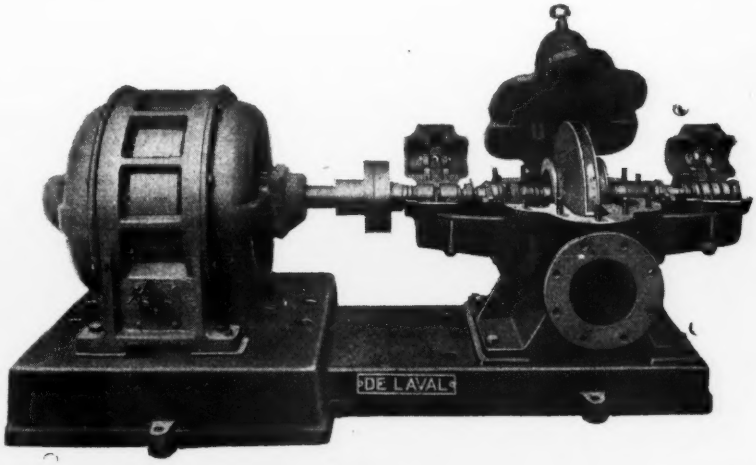


Figure 4

devices for taking care of the unbalanced thrust.

Steam driven service pumps, whether centrifugal or reciprocating, should be controlled by constant pressure (not constant excess pressure) governors. They function by throttling the steam to such a flow as will permit the pump to run only fast enough to maintain the pressure for which the governor is set. The motor-driven centrifugal machine must depend upon the characteristic design of its water end to limit its pressure to a safe value.

Water Wells

Occasionally a cement mill may be located in a flat alluvial region where the water supply is not all that could be desired. Pumping from streams may not be feasible either because of the expense involved, the great rise and fall of the streams, or the amount or character of the solids carried in suspension. If the property happens to be underlaid with water-bearing sand or gravel, it is possible that a perfectly satisfactory source of water may be developed from it.

The method of making such a supply of water available does not seem to be as generally known as it should be, and so a few lines will be devoted to it. The sand or gravel in which the water occurs is usually overlaid by a stratum of clay or other impervious material, and to get an idea of the true conditions a five or six inch hole may be sunk into the gravel by an ordinary churn drill. This will show the depth and nature of the water-bearing bed, and pumping from this well will determine the character of the water that may be expected. If everything is found satisfactory, an open steel cylinder about four feet in diameter is sunk vertically by excavating the material from the inside and weighting it until it sinks. More rings are added to the top of the cylinder and excavating continued until it has sunk to a depth based on the findings of the churn drill. A suitable casing, usually about 18 or 24 inches in diameter, is sunk in the center of the large one by pumping the mud out of the lower end with a bailer such as is used in oil well work but very much heavier. The lower sections of this inside casing are made up of perforated or slotted screens, and a sufficient length of screen is used to include most of the water-bearing layer as shown by the churn drill. When the inner casing with its screens has reached the proper depth, bailing is continued while a carefully screened gravel whose particles are about ⅜ or ½ inch in size is thrown into the well between the inner and outer casings. Bailing will eventually cause the earth around the inner casing to sink, and it is followed down by the added gravel. Bailing is continued until the gravel has worked all the way down around the screen and begins to appear in the bailer. The result is that the screen is surrounded by a layer of gravel too coarse to go through the meshes but fine enough to act as a strainer for the water before it enters the well. This gravel also greatly increases the area of the surface through which the water bearing stratum may supply the well. The conditions at this time are shown in Figure 5.

The pumps used in such wells are a special vertical type, one make of which is illustrated in Figure 6 (e). The motor is vertical, and the weight of the revolving parts is carried on a ball, Kingsbury or other form, of thrust bearing. The pump itself, which must be near the bottom of the well where it will always be submerged, may have one or more stages according to the service needed. The pump in the illustration has two stages.

Wells of this type may have a capacity of over a thousand gallons per minute, and can serve as an excellent source of water around a cement mill. Where such water is found in sufficient quantity to use as circulating water for condensers, it is of special value, as it is always cool. When it is used to maintain a supply in a surface pond, the pump motor may operate under float control.

Wet Process Plants

The characteristic feature of mills using this method of manufacture is that the raw materials are ground with enough water to make a thick fluid mass called slurry, and the mechanical handling of this is an altogether different problem than that of moving dry materials.

Where the question is one of direct vertical lift, the chain and bucket elevator will give very good service. Of course the boot and casing of the elevator must be water-tight, or as an alternative the foot shaft may be mounted in bearings in a concrete pit which takes the place of the conventional boot. The casing has in one or

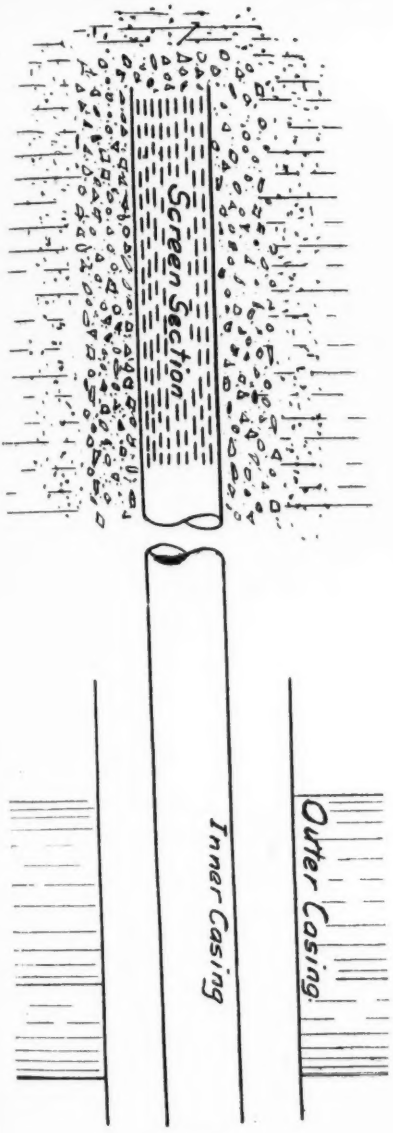


Figure 5

two instances been made of reinforced concrete. Slurry may be led to the foot of the elevator in troughs or launders of proper slope, and may be taken away at the top in the same way.

While the open launder is a very simple and inexpensive contrivance, closed pipes have the advantage of convenience of arrangement and the

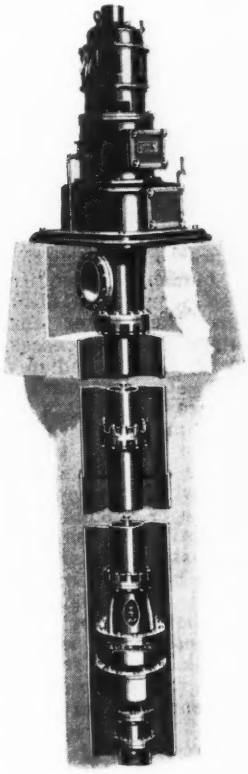


Figure 6

use of valves and fittings for diverting the flow into any desired number of directions, while pipes involve some method of pumping. This may be done by means of (1) the plunger pump, (2) the centrifugal pump, and (3) compressed air.

Plunger Pumps

The consistency of slurry makes the design of a pump to handle it much different from that of one intended to pump water. It is regretted that no illustration of such a machine is available, but it may be said that in general a slurry pump is built along the same lines as the "stuff pumps" used in paper factories for handling a suspension of paper fiber in water. Pressures are not very high, which is easy on the packing. The valves are very large and are frequently made of hollow brass balls six or eight inches in diameter, and the ports and liquid passages are all in the same

liberal proportions so as to offer as little resistance as possible to the flow of the slurry. These machines are usually made with single-acting plungers instead of pistons, so that the packing is external where it is accessible and where leakage can be seen.

Centrifugal Pumps

These have been in use for many years in handling slurry, and do excellent work in this service. The pressures are always moderate, so that nothing more complicated than a single stage machine is required. The extreme refinements of design that characterize the better centrifugal water pumps are not necessary in working with slurry, and in fact are detrimental. The essential features called for are ruggedness and simplicity, even at the sacrifice of efficiency in the use of power. The standard type has side suction, with a runner on which the vanes are cast on to the side of a solid disc. Such a pump will have some end thrust, but with the pressures used in cement mills this can be cared for by a properly designed thrust bearing. The stuffing box should be for sealing purposes only, and should not be called upon to act as a guide for the shaft, which implies that there shall be two bearings far enough apart to hold the shaft steady.

When a centrifugal slurry pump is in constant use, it is wise to have the runner chamber provided with renewable liners. Such a machine is shown in Figure 7 (f). It also has the other features mentioned above, and it might be well further to have the shaft protected by a wearing sleeve on the part subject to the action of the packing. The cutting action of slurry imbedded in soft packing is rather severe, and it would be cheaper to renew the sleeve rather than the entire shaft. These machines may be driven by belt or by direct-connected motor, the latter being preferable if the speed and design of the pump can be made suitable for the desired lift.

As centrifugal pumps are not self-priming, they must be set low enough so that the slurry will run to them by gravity, and the same arrangement is highly desirable, though not absolutely necessary, for plunger pumps. In figuring the size of the piping, and particularly the suction, allowance must be made for the high friction of flow of the thick slurry.

Compressed Air

This system of pumping exposes nothing to abrasive wear except the valves, and these will last two or three years. The operation is best explained by means of Figure 8, which is a diagrammatic sketch of the proper arrangement of parts. The two tanks must be set low enough to fill by gravity, and should be designed to withstand the highest pressure of the compressor, though the pressure used in pumping will depend on the height to which the slurry is to be lifted. They are best set vertically so that

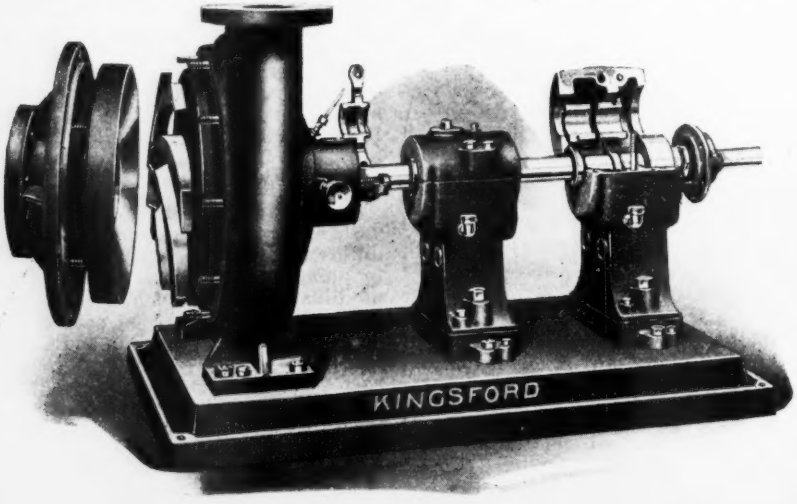


Figure 7

they will completely empty themselves at every cycle. If laid on their sides solids from the slurry will settle in the less active parts, and after some time it will be found that over one-third of the interior is filled up and not available for pumping.

Starting with all valves closed, inlet valve A and vent G on tank Number 1 are opened. When the tank is full, as shown by the appearance of slurry at G, valves A and G are closed and discharge valve C and air valve E are opened, and the slurry is forced out of the bottom of the tank by the air pressure. The fact that the tank is empty can usually be told by placing the hand on the discharge pipe and feeling the vibration caused by the rush of air with the last of the slurry. The provision of duplicate units as shown permits one tank to be filling while the other is discharging, and a good operator will learn to shut off the air at valves E and F before the tanks are entirely empty, doing the

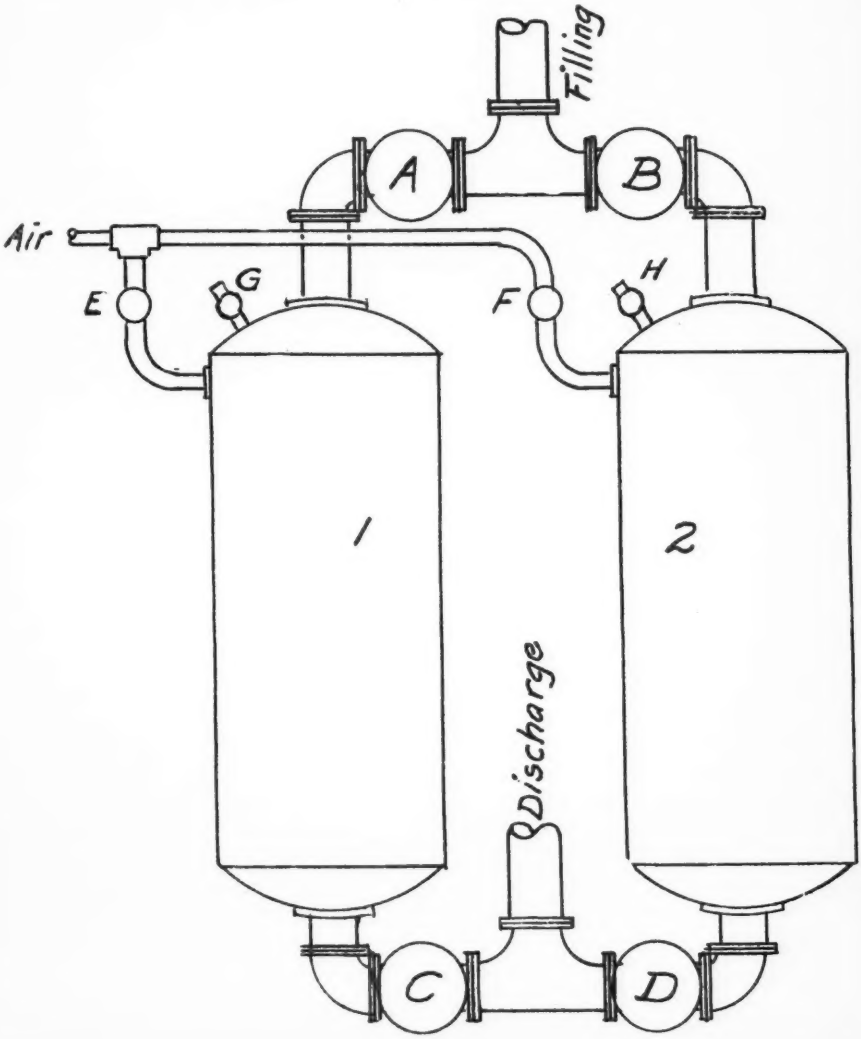


Figure 8

last of the work by the expansion of the air already admitted.

This system requires a suitable air compressor, best located in the engine room, but the apparatus in the mill room has the advantage of extreme simplicity. The writer does not know of any comparison having been made between the cost of power for compressed air pumping with that of the other two methods, though when large compressors are already in use for supplying rock drills, it is probable that the needs for slurry pumping would be a comparatively small part of the total. The system would be inoperative if the compressor were out of commission, so that some relay such as a spare compressor or a centrifugal pump should be provided.

It has been shown that the pumping problems of a dry process cement mill are those of any well designed factory power plant, while in wet process mills special methods which have been described have been developed for handling slurry.

(a) Dean Bros Co., Indianapolis, Ind.
(b) Lea-Courtenay Co., Newark, N. J.
(c) Mason Regulator Co., Boston, Mass.
(d) De Laval Steam Turbine Co., Trenton, N. J.
(e) American Well Works, Aurora, Ill.
(f) Kingsford Foundry & Machine Works, Oswego, N. Y.

Newspaper Errors

Many newspapers have carried accounts of a recent blast at the Columbia Quarry Company's plant at Krause, Illinois, and not a single one was correct.

It was reported that 150,000 tons of stone were "shot" at a cost of $68,000. As a matter of fact 235,000 tons were brought down at a cost of something under $40,000, which cost included the stripping, cleaning, drilling dynamite, fuse caps, secondary drilling and preparations for transportation to the mill. This figure also included an allowance for overhead.

Pit and Quarry refrains from publishing "rumors" or "reports" unless they are first verified and unless the facts, which seldom appear in the newspaper account, are secured.

The Osgood Co., manufacturers of excavating machinery, Marion, O., has recently issued its bulletin No. 256, dealing with gasoline, oil and electric power shovels. The Osgood ¾-yd. power shovel and its combinations are featured.

Ohio Gravel Producers Meet

Cedar Point, Ohio, on August 3rd, 4th, and 5th was the scene of a meeting of the Ohio Sand and Gravel Producers in conjunction with the Executive Committee of the National Sand and Gravel Association.

On August 3rd the Association discussed freight rates and state problems. Mr. Guy C. Baker, the Association Secretary and Vice President led the discussion with his report. On August 4th the Executive Committee of the Association held an open meeting. John Prince, President, addressed the group discussing the activities of the National Association and especially the new engineering bureau which is being organized.

Mr. Earl Zimmerman, General Manager of the Ohio Gravel Ballast Company presented a report on the work of the ballast committee of the National Association. This committee was appointed for the purpose of making an investigation and report on a general gravel specification for railway ballast.

Mr. Hugh Haddow reported on the work of a committee, of which he is chairman, which was appointed for the purpose of investigating the highway specifications in New York and Pennsylvania. The issue is to convince the state highway departments in question that gravel aggregate is the equal of crushed stone as aggregate. At the present time gravel is not accepted on primary roads. Mr. L. A. Boulay, Director of Highways for Ohio, also addressed the group. His remarks were largely in the form of suggestions on selling methods.

Mr. V. O. Johnston, President of the Lincoln Sand and Gravel Company; Mr. S. C. Haddon, Secretary of the Indiana Sand and Gravel Association; and Col. H. C. Boyden expressed thoughts of interest during the sessions.

Prof. Duff A. Abrams, professor in charge, Structural Research Laboratory of the Lewis Institute, Chicago, was the principal lecturer at the course on design of concrete mixtures and field control of concrete at Birmingham, offered to engineers through the courtesy of the Portland Cement Association in Alabama. He also made an inspection of Chilton county highways now under construction, accompanied by his field assistant, F. S. Kelly.

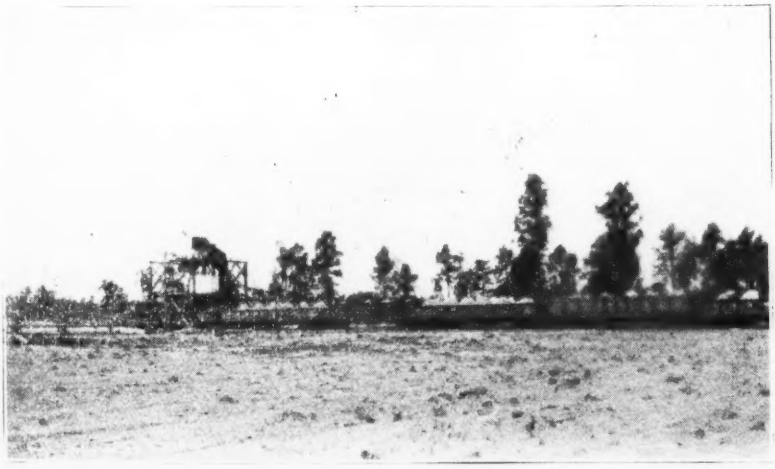
Employing Efficient Hydraulic Methods In Producing from Bank Deposit

Diamond Sand Company Operating New Modern Plant in Florida. Producing 2000 Tons Quality Sand Daily from Excellent Deposit

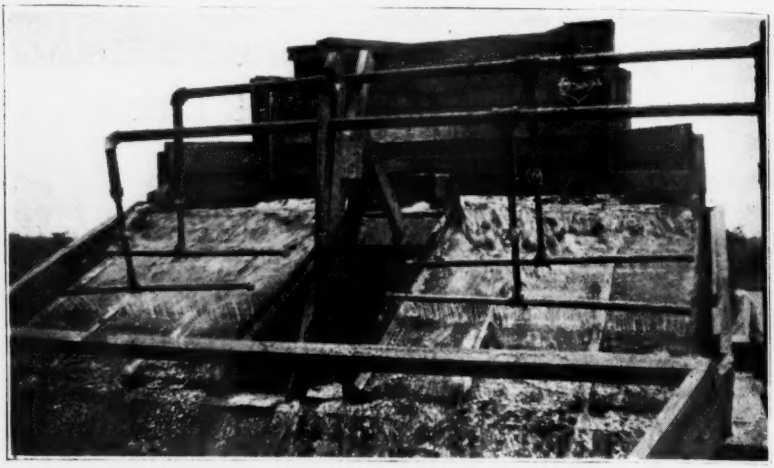
FLORDIA is the second largest state east of the Mississippi River. This generous area overlies massive mineral bearing rocks cemented together with clays. This state has the most extensive phosphate deposits in the world. There are also wide-spread deposits of limestones, marls, Fuller's earth, kaolin, sand and gravel, gypsum and diatomaceous earths.

The phosphates of Flordia, of which this state mines about two thirds of that produced in the United States, are generally divided into four varieties; the land pebble, river pebble, hard rock and soft. The land pebble phosphate is the most important from the standpoint of production and value. At the present time none of the soft phosphate is being mined. In 1924, Florida shipped 2,336,000 long tons of phosphate valued at $7,507,000, more than nine-tenths of which was land pebble phosphate. A considerable quantity is converted to the mono-calcuim salt, (superphosphate), in Jacksonville, by treatment with sulphuric acid. A product known as non-acid phosphate is manufactured in Florida by heating phosphate rock with a solution of K_2CO_3 and K_2SO_4 and then calcining the mass at 1200-1400 degrees centigrade. Ten to twelve per cent of the phosphate is converted to a form for use as plant food.

Florida is essentially a limestone state. The oldest exposed formation is a limestone named Ocala because of its occurence in and near that city. The lime industry of the state is centered about this city. Some of the limestone in this region analyze as high as 99.15 per cent in calcium carbonate. Another excellent limestone is the Marianna located in and near the city of that name. An argillaceous limestone occurs along the Apalachicola River in the vicinity of River Junction. This limestone was once used in the manufacture of a natural cement. Vast deposits occur in southern Florida being well developed in the region about Palm Beach and Miami. Deposits of coquina, a shell limestone, can be seen at different points along the east coast of Florida. This coquina has the



Wash Mill and Cars Loaded



Box At Top of Washer and Vibrating Screen

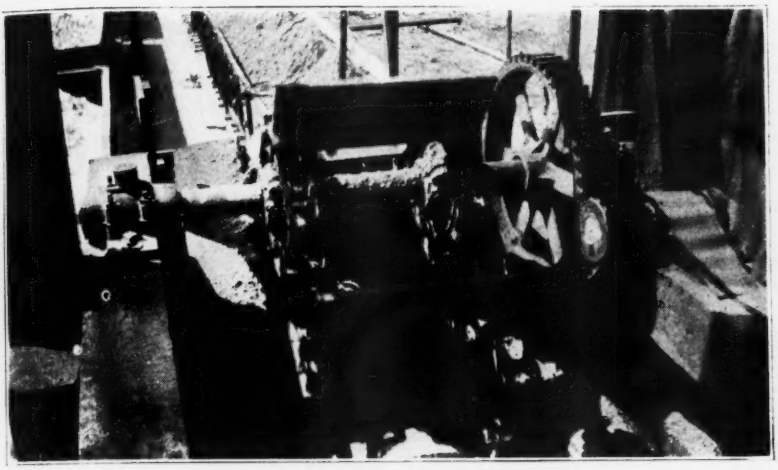
unique distinction of being the first building stone used in Florida. In 1923, Florida produced 1,412,410 tons of limestone at a value of $1,236,226.

Florida was the leading state in output and value of Fuller's earth in 1923, and has been from the beginning of the industry. Large deposits are mined in the southern part of the state in Manatee county, and in the uorthern part in Gadsden county. Kaolin of sedimentary origin occurs in Florida also. The kaolin is mixed with coarse sand which is removed by washing. In addition to the Fuller's earth and kaolin, there is an abundance of clays suitable for the manufacture of building brick, tile and clay products.

Gypsum was discovered in Florida more than twenty years ago. The large deposits are not accessible at all times as they are located in some very low areas which are subject to periodic overflow. The principal deposits are in the Lake Panasoffkee region of Sumter and Citrus counties. The deposits are quite disconnected as they occur on several islands in the region mentioned.

Diatomaceous earth was produced in Florida a number of years ago, and there has been an increasing interest in this material recently. The best

Dewatered Sand Being Discharged from Cone for Second Washing

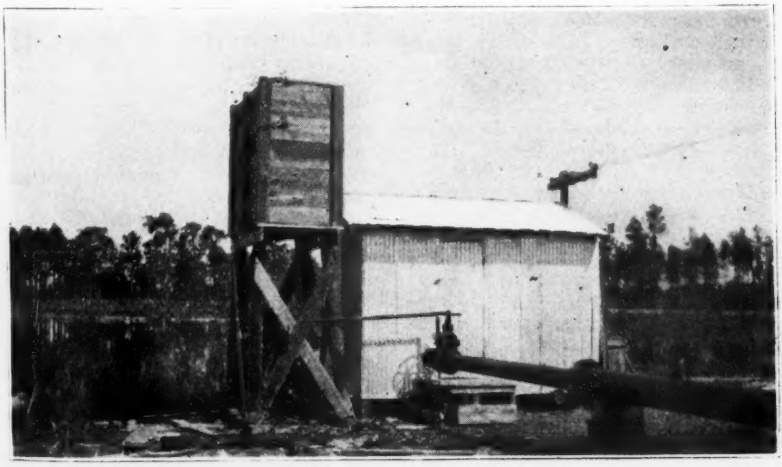


Drag Which Delivers Sand from Tank

known and the more developed deposits occur in Lake county. The diatomaceous earth is found in Florida in fresh water lakes or in the bogs frequently bordering them. In its crude state is resembles peat but develops a grayish color when dried. This grayish color is due to inorganic matter. By burning, this color disappears and the resulting product is a fine light mass consisting essentially of the microscopic shells of fresh water diatoms with practically all foreign material, such as sand or clay, absent. The burned product has a white or creamy color, is light in weight and porous in texture.

The sand and gravel industry of this state is of greater importance than is generally recognized. Excellent deposits can be found in almost any part of the state. The rapid progress which the state is making in highway, railway and building construction is proving to be a stimulus to the sand and gravel industry.

The Diamond Sand and Gravel Company has embarked upon an enterprise that should flourish under the boom which is sweeping the state of Florida at the present time. This company was organized in March, 1925, as a $300,000.00 corporation with C. C. Memminger, President; E. C. Stuart, Vice President; S. D. Gooch, Vice President and General Manager;



Pumping Station Which Supplies Water

and J. K. Stuart, Secretary-Treasurer.

The plant of this recently organized company is located four and a quarter miles east of Lake Wales, Polk county, Florida. It is served by the Seaboard Air Line Railway which passes through the property. Lake Wales is located in south central Florida, about 100 miles north of West Palm Beach and about 140 miles from Palm Beach. A new railway has just been completed from West Palm Beach to Palm Beach. The plant has favorable location as it can serve the east and west coast as well as the interior of Florida.

Another interesting factor is that the deposit contains, it is claimed, the best sand for building purposes in the state. The sand is composed entirely of sharp quartz grains and is marketed free from such impurities as clay loam, silt and phosphate. The Pittsburgh Testing Laboratory has given the sand the following grading:

Passing	200	mesh	sieve	0.2	per cent
"	100	"	"	0.2	" "
"	80	"	"	1.0	" "
"	50	"	"	13.2	" "
"	40	"	"	14.8	" "
"	30	"	"	21.4	" "
"	20	"	"	31.0	" "
"	10	"	"	17.4	" "
"	4	"	"	0.8	" "

The same laboratory has given the following strength tests, which show it to be an ideal concrete sand:

Twenty-four hours old	109.0
Forty-eight hours old	108.5
Seventy-two hours old	114.6
Seven days old	127.5
Twenty-eight days old	121.0
Strength Test, Twenty-eight days	
2x4 inch cylinders	135.0

The property of the company comprises 220 acres with an average depth of more than 20 feet of marketable sand. The sand produced is sold under the name of, "Diamond Sand." The deposit is a bank deposit, and the sand is produced by modern hydraulic methods. Water for the mining and washing operations is secured from a large lake adjacent to the property. An Allis Chalmers eight inch centrifugal pump delivers the water through a ten inch pipe line to the plant.

The face of the bank is broken down by a heavy stream of water, and the sand washed down is drifted to a sump where it is picked up by an eight inch Georgia Iron Works pump of the heavy duty type and pumped through an eight inch pipe line several hundred feet long to the washing and screening plant.

The sand and water are delivered at the top of the washing plant into a tank. From this tank the material passes to two ¼ mesh Sturtevant motor vibrating screens where all the sand that passes meets the Federal and State specifications. Sprays of water are playing on these screens at all times. The oversize, which consists of quartz pebbles and sandstone pebbles, is conveyed to a storage pile.

The sand and water passing goes directly to a large automatic Link Belt sand separator where all the water, silt and loam are run off through a launder away from the separator. The dewatered sand is delivered to a large tank. Clear, fresh water is added to the tank, and the sand thoroughly scrubbed by means of paddles. After this second washing the sand is dragged up an incline out of the tank and into bins. The dirty water is drained off and run through a second launder away from the washer. A double track runs under the bins, and cars are loaded easily. An electric car puller spots the cars for loading.

The entire plant has a capacity of 2000 tons per day. The plant is electrically operated throughout. General Electric and Westinghouse motors with a total of 200 H. P. are used. Power is furnished by the Florida Public Service Company. In view of the present boom in Florida the Diamond Sand Company will soon increase the present capacity of the plant.

Pennsylvania Drills

Looking into the earth to learn what are the various strata of which it is composed, is made possible by the Pennsylvania Drilling Company, 1808-14 W. Carson Street, Pittsburgh, Pa. In a folder recently issued by this company, illustrations are shown of a number of cores of sub soil strata taken out of the ground by the Pennsylvania Company's drills.

These people are contractors for Diamond Core Drilling and Prospecting, and they also test foundations for bridges, buildings and dams. They are prospectors for coal, oil, limestone, talc, clay, copper and all other minerals, and bids are cheerfully submitted on drilling anywhere in the United States, Canada, Mexico or South America.

HUBBARD
STEEL CASTINGS

Rough or Machined

for the

NON-METALLIC MINERAL INDUSTRIES

From 1 to 100,000 lbs.

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EAST CHICAGO, INDIANA

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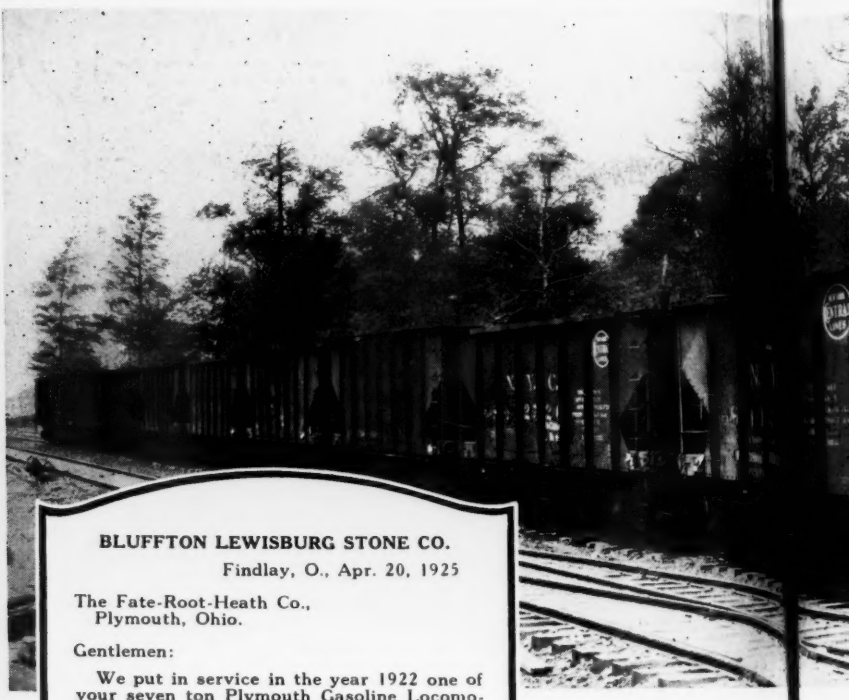
CLEVELAND
PITTSBURGH



BLUFFTON LEWISBURG STONE CO.

Findlay, O., Apr. 20, 1925

The Fate-Root-Heath Co.,
Plymouth, Ohio.

Gentlemen:

We put in service in the year 1922 one of your seven ton Plymouth Gasoline Locomotives and at that time we checked the cost in comparison with steam and found we had a savings of over 50 per cent. In the year 1924 we installed another one of these locomotives and we found both of them to be very satisfactory and we certainly do recommend them for industrial haul.

Yours very truly,
THE BLUFFTON-LEWISBURG STONE CO.
(Signed) Allen Patterson,
Sec'y and Treas.

Fifty P Ce

Why do Quarrymen y Ply increasing numbers eve ear?

Because they cost le oper

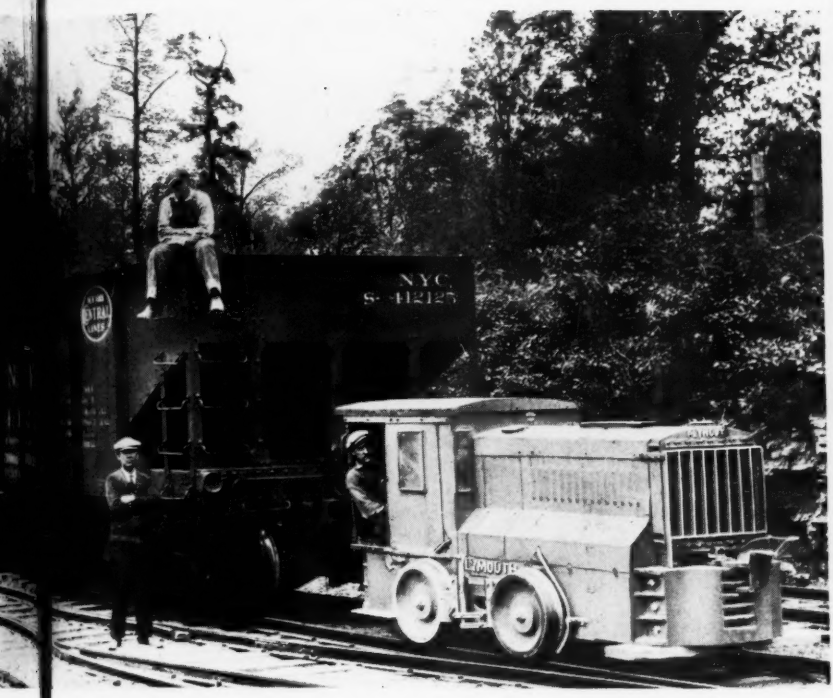
Because they are m power

Because they are alw ready to keep up when no use, troubles.

TH ATE-

PLYM

Gasoline



y P Cent Cheaper Than Steam

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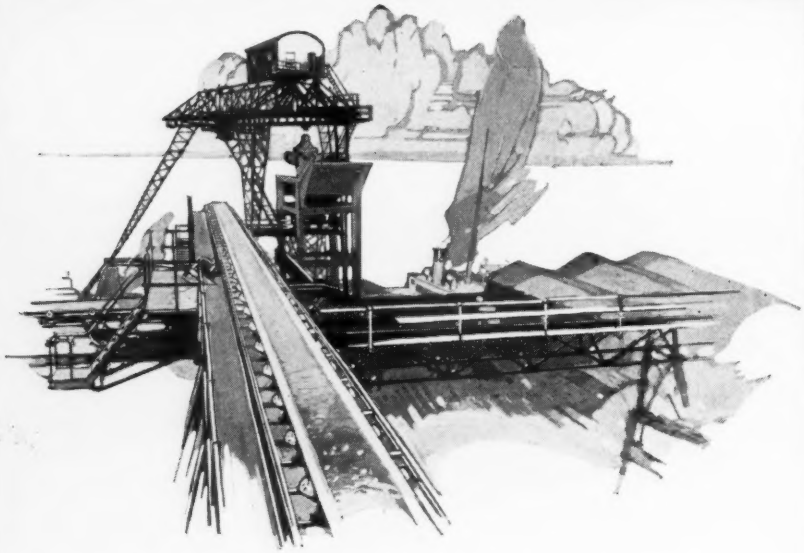
are m powerful.
are alw ready; no steam
en no use, no boiler

They are simpler, more flexible, and longer lived.

Repeat orders tell the story. What Mr. Patterson says in the adjoining column should be convincing proof of the advantage of Plymouth Haulage.

TH ATE-ROOT-HEATH Co., Plymouth, Ohio.

M OUTH
Locomotives



Cut Your Handling Costs With Dependable Conveyor Equipment

One of the most modern plants in the country for the handling of sand and gravel is that of The Ohio River Sand Company, at Louisville. Here material is brought in by river barge and unloaded by the Brownhoist Bridge Crane. It is then distributed to various bins by a series of Brownhoist Belt Conveyors.

Brownhoist equipment is built for hard work and years of continuous service. Behind each Brownhoist unit is the wide experience of the Brownhoist staff of engineers. Their proved knowledge and skill in meeting and handling problems insures the installation of equipment best adapted to your particular need.

Brownhoist engineers have helped reduce handling costs for hundreds of plants. Their advice is available to you for any type of handling problem.

The Brown Hoisting Machinery Co., *Cleveland, Ohio*

Branch Offices: New York, Chicago, Pittsburg, San Francisco, New Orleans, London, Eng.

BROWNHOIST

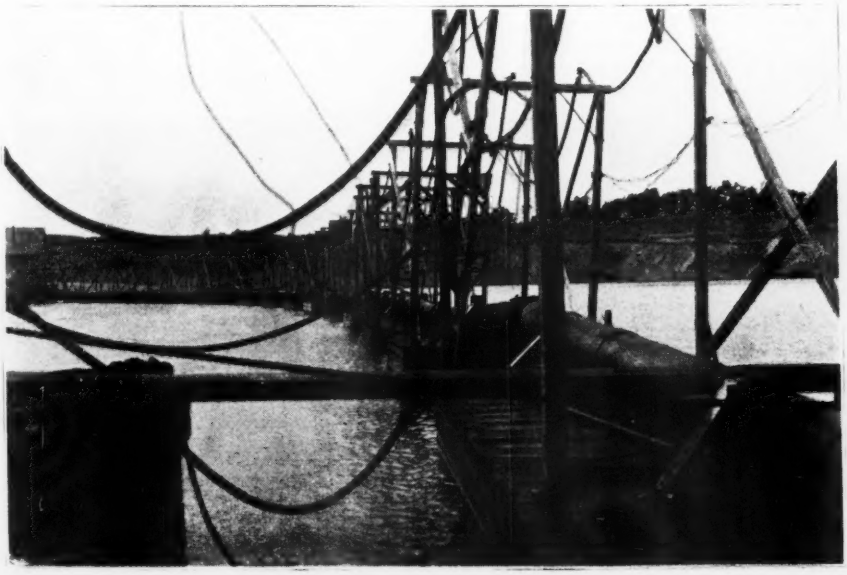
MATERIAL HANDLING MACHINERY

A Most Unique Hydraulic Operation In the Sand and Gravel Industry

The Largest Sand and Gravel Hydraulic Unit in Operation. Interesting Hydraulic Principle Involved in Excavation

UNUSUAL is a word which describes many features of the Ward Sand and Gravel Company. The plant operated by this company has long been considered unusual because if its tremendous production of 10,000 tons of material a day. It may be of interest to know that Mr. Ward, President of the company whose operations are the subject of this article, is trying to increase this production to 15,000 tons a day. Such a production will be most unusual. Another unusual feature probably not generally known is the interesting method by which it is proposed to increase the production of the plant from 10 to 15,000 tons per day. In our opinion Mr. Ward's attitude toward the problem involved in operating his plant is unusual. In the first place he has abandoned orthodox methods of hydraulic practice in the sand and gravel industry. Then he worked out a principle which he has determined to experiment with at great expense to ascertain its practicability. Furthermore, he makes no claims as to the possible success of his principle which has received practically no approval of engineers. It is an interesting fact that Mr. Ward's plant produced 600 tons in one hour operating under his principle. Every factor involved is being carefully studied and experimented with both as individual and associated factors. In connection with this article we are presenting the only pictures ever taken showing the key to the principle involved and giving to the best of our ability the methods being used. Mr. Ward's efforts merit the support and encouragement of the entire sand and gravel industry.

The principle with which Mr. Ward is experimenting is involved in excavating the material below the waterline. A 6 foot suction pipe projects at an angle of 45 degrees from a U shaped 12 inch pipe line. One end of the U shaped pipe line is connected with a specially designed dredge equipped with Allis Chalmers pumps. The other end of the U shaped pipe line is connected with the main pipe



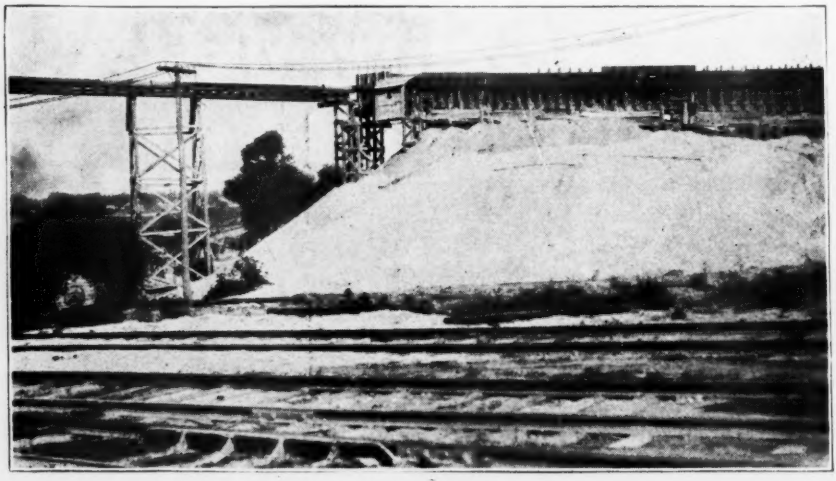
The Pipe Line from Intake to Shore

View of U-Shaped Pipe and Suction Extension

line which delivers to the washing and screening plant. The entire U shaped pipe with the 6 foot 15 inch suction projection is submerged. Water is introduced from the dredge and at a high velocity forced through the U shaped pipe. A 6 inch nozzle is placed just ahead of the suction pipe. As the water passes around the U in the pipe and over the opening of the suction pipe, sufficient vacuum is created to suck the material up through the pipe and into the U where the onrushing water carries it to the main pipe line.

The suction pipe has jet heads on the intake end. There are eight ¾ inch nozzles around the intake which are supplied with water under a pressure of 150 pounds per square inch. These eight jets of water break up the material in front of the suction pipe.

The U shaped pipe is submerged at all times. Experiments have shown that if this pipe is too near the sur-



Railroad Track and Sand Storage

Mr. Ward and the Key to His Principle—The U-Shaped Pipe

face the material has a tendency to back up in the pipe. It has also been found that the lower the U shaped pipe is lowered and the nearer to the bottom the suction pipe is kept, the greater is the amount of material excavated. Many factors have not yet been definitely determined such as the most efficient size of pipe in the U or the most efficient size for the suction pipe. The U shaped pipe is raised and lowered from a steel bridge by means of a Thomas electric hoist located on the dredge. This dredge houses the pumping units and the starting resistances for the large motors.

A low pressure stream is directed against the bank above the water line. This stream of water loosens and carries the caved material to the suction pipe. The position of the dredge and the U shaped pipe is controlled by deadmen on the shore. The

Electric Generator and Conveyor Belt

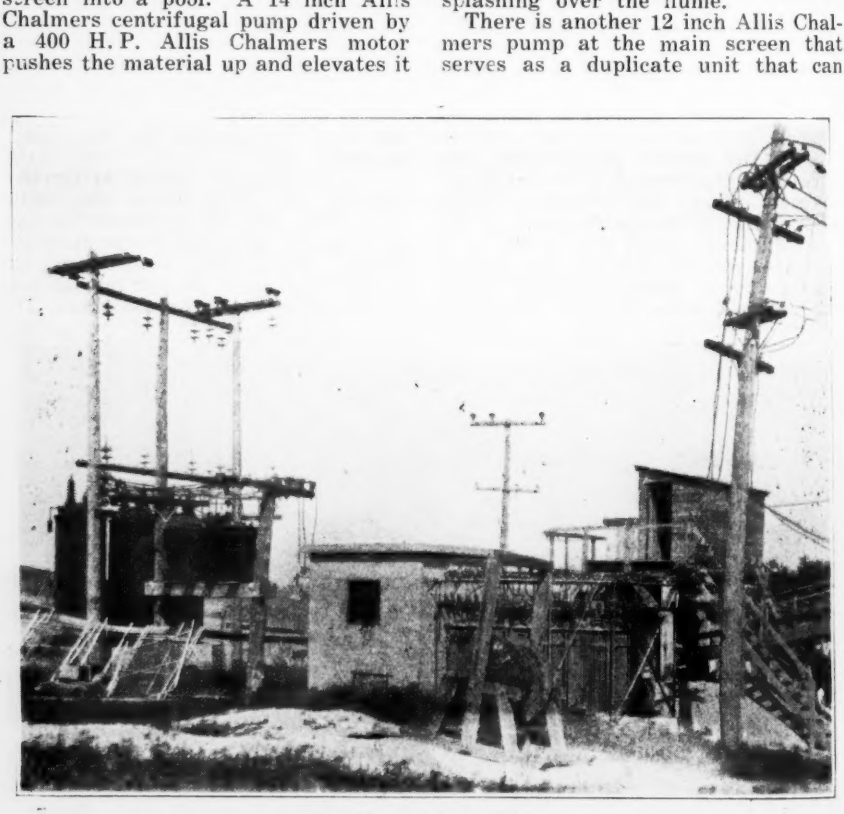
material is excavated from a depth of 30 feet below the water surface and with the 35 feet above the water surface the total working face is 65 feet.

There are about 1100 feet of pipe line in the main line. This pipe runs from one end of the U shaped pipe over pontoons to the shore. The pipe line consists largely of American Rolling Mill Company pipe.

The pipe line conveys the material to the main gravity washing screen near the shore about 20 feet above the water level. This screen is 30x12 feet. The oversize material is screened out first and is delivered to a number 7 Acme jaw crusher. This crusher discharges to a belt conveyor which delivers material to the screens for classification. The gravel is screened out first and is delivered to the screens by a 30 inch belt conveyor while the sand and water are conducted to sand settling boxes. This sand falls through the main washing screen into a pool. A 14 inch Allis Chalmers centrifugal pump driven by a 400 H. P. Allis Chalmers motor pushes the material up and elevates it through a pipe line to the sand box. This box is 5x2 feet at the top and 2x2 feet at the bottom. This box discharges to a wood sand flume which is 120 feet long and four feet wide. The bottom of this flume has 1⅜ inch holes, four in a row, starting about 10 feet from the receiving end and spaced 2 feet apart the remaining length of the flume. By using plugs in these holes almost any required grade of sand can be secured.

The sand is deposited through the holes in the bottom of the flume onto storage piles. The material is reclaimed from these storage piles by a 24 inch tunnel belt conveyor which conveys to the loading bins over the railroad track. The waste and sulphur sand is drawn off at the discharge end of the flume and delivered back to the pond. As the material comes through the sand box to the flume, it is thoroughly agitated. The discharge to the flume from this sand box is covered to prevent material splashing over the flume.

There is another 12 inch Allis Chalmers pump at the main screen that serves as a duplicate unit that can



The Electric Power Plant

also be used for delivering any material in excess of the current need to a storage pile.

The oversize before going to the Acme crusher passes over a grizzly built of rectangular bars spaced two inches apart. The gravel or material from 2 inches down to one quarter of an inch is transported underground beneath the railroad tracks and then up a slight incline to a belt conveyor at right angles which transfers the material up an 18 degree incline where is is transferred to another belt conveyor on a trestle. This trestle conveyor delivers the gravel to two Mitchell screens where the several sizes are graded. Each of these Mitchell screens is protected by a wire screen of a little larger mesh than the Mitchell screens. This arrangement reduces the wear on the screens by keeping out all oversize. This oversize material is plowed from the belt conveyor before the material reaches the Mitchell screens. A strip of rubber belt on this plow arrangement prevents material catching underneath and causing excessive wear on the belt conveyor.

The material is stored on the ground and is drawn off underneath the storage piles by a tunnel belt conveyor. This 30 inch tunnel belt conveyor receives the material through the bin gates and carries it up an incline to a loading bin over the tracks. Cars are loaded from this bin by gravity. The cars are spotted under the bins with the use of a two drum Thomas hoist as car puller. There are two loading bins over the railroad track. The incoming cars jolt the loaded cars and with this momentum they travel down the track by gravity. The plant is located on a double track spur which extends some distance beyond the plant. With continuous loading a car, on the average, is loaded every two minutes.

The trestles for the conveyor belts and pipe lines are built of heavy timber. The tunnels are also lined with timber. The loading bins are built of heavy timber.

The plant is operated continuously averaging about 20 hours a day actual running time. There are 58 men employed at this time. These men are divided into two shifts of 12 hours each.

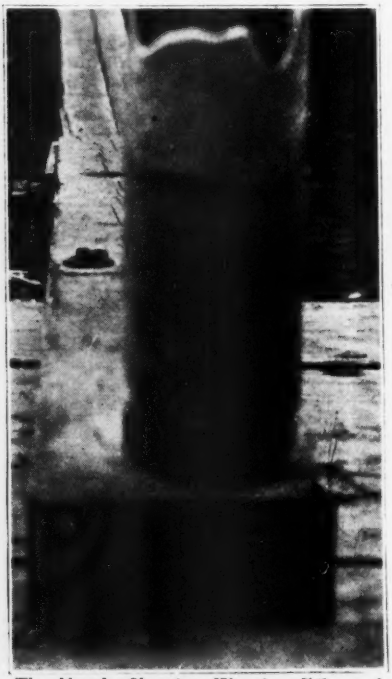
The plant is electrically operated by power purchased from the Detroit Edison Company. Each unit is driven by individual General Electric motors. The plant is electrically operated throughout. The large motors are 3 phase 60 cycle 2,300 volt and some of the smaller motors are 220 volts. All are General Electric motors. There is a total of 1400 H. P. The output is consumed largely in the construction of roads, buildings and concrete bridges. A considerable portion of the output is also consumed by the railroads who haul in a train of

Part of Deposit Being Worked

freight cars and have it loaded in a few minutes without disconnecting the engine.

The deposit, covering 300 acres, is on the edge of the village of Oxford. This little village has a population of 2,000. The deposit lies in stratas of about two feet of small pebbles then a few inches of sand and the next strata of small pebbles and a few inches of sand. Clay and debris of all kinds are noticeably absent. Considering the whole deposit the sand probably runs about 50 per cent. Engineers estimate that operations, producing at the present rate of 200 cars daily, can be continued for 300 years to advantage.

The Ward Sand and Gravel Company has two and a half miles of railroad siding at the plant, and shipments are made over the Grand Trunk Railway System and the Michigan Central. Single cars have been loaded in ten seconds but for continual loading the record is 31 cars loaded in 62 minutes. No expense has been spared in making this plant a most modern sand and gravel plant of large continuous production. Operations extend through seven or eight months of the year. Last year the plant shipped over 36,000 cars of sand and gravel.



The Nozzle Showing Wearing Effect of Clean Water

The Ward Sand and Gravel Company has its offices in Detroit. Mr. F. L. Ward is president and general manager, while Mr. E. M. Hammond is treasurer. The plant represents Mr. Ward's ideas of design and construction. He has established an enviable reputation in the sand and gravel business through this Oxford plant which is probably the largest in the world, and undoubtedly the largest hydraulic sand and gravel unit.

Flory Hoists

A new publication on Flory hoists for construction and material handling operations—Catalog No. 31—has been issued by S. Flory Manufacturing Co., Bangor, Pa. This book describes the general line of Flory standard hoists as built for the particular requirements of contractors, quarrymen and industrial plants.

An outstanding characteristic of Flory hoists is the constant striving for dependability, evidenced by the liberal use of metal in all parts requiring stability, and the generous sizes of frictions, gears, shafts, bearings, etc., which bear the constant burden of use and wear.

All Standard hoists are made to jigs and templates, insuring unuiformity and interchangeability of spares and repair parts, which are easily attached by any ordinary mechanic. A special feature of the bed plate design is that the front ends are provided with machined bosses, spot drilled, so that a single drum hoist may be easily converted into a two-drum unit, or a two-drum unit into a three-drum hoist, by attaching the additional drum in the "field" without special machining or fitting.

In addition to the complete standard line of hoists, there are hundreds of special designs for those who need them. The book is illustrated with numerous engravings showing all the standard types of hoists made.

The Laclede-Christy Clay Products Company announces the following changes in the organization. W. J. Westphalen, Vice-President and Treasurer succeeds R. D. Hatton who resigned; J. H. McKelvey is Vice-President in charge of sales; J. M. Baggot, Secretary; and H. L. Inger, Secretary.

Hydraulic Stripping

By G. B. Massey*

HYDRAULIC stripping in the past was undertaken only where the physical conditions were favorable and sufficient water under a natural head was available. In recent years, however, the head has been created by pumping; the water has been used over and over; and the physical conditions in some cases have been far from favorable.

Flowing water will convey solids, depending upon the velocity of the water, the shape and nature of the surface of the pipe, flume or sluice, the grade and depth of water and the maximum size and shape of the solids. Sand requires one foot per second velocity, gravel two feet per second, broken stone four feet and large stones six feet per second to be carried forward in a stream.

In hydraulic stripping operations this can be stated better in the necessary grade of sluices to be efficient. Three and a half per cent is the minimum grade of flume at all practicable, and four per cent has been used. Six per cent is the minimum advised, and the usual grades are seven to ten per cent. Suitable material may be sluiced from a bank by a running stream of water. This method can sometimes be used where there is a large quantity of water available with sluicing grades.

Hydraulic giant guns or monitors are of two types. The double-jointed ones rotate horizontally on a ball-bearing center pin, which takes the upward thrust due to the change of direction of the flowing water, or with ball-bearing flanges. The joint for rotating in a vertical direction is a ball joint and entirely independent of the other joint. These are the giants used for high pressures and in large sizes.

For moderate pressures and sizes the nozzle man can move the nozzle itself. For higher pressures, a deflector is placed between the monitor and the nozzle, and for the highest pressures the deflector is an integral part of the nozzle.

The other type is a single ball joint which takes care of the horizontal and the vertical motion. These monitors are usually moved by a wooden bar fastened to the monitor and extending back past the joint far enough to be conveniently handled.

In pumping a mixture of solids and water through a pipe line the minimum velocity employed is ten feet per second and sometimes twelve and fourteen feet.

The pumps which supply the pressure water are either multi-stage centrifugals or single stage centrifugals in series. The latter is more flexible, permitting of using the pumps in parallel or series. Thus with four pumps they can supply one volume at low or high pressure, or two volumes at low or high pressure, or four volumes at low pressure. Pumps for this service should have an efficiency of 85 per cent at least if they are pumping clear water.

Most of these pumps are driven direct by motors which can be of the squirrel-cage type. If a multi-stage pump is used, a slip ring induction motor with 30 per cent speed control will allow a variation in the volume of water and the pressure. A separate priming pump should be provided to prime these pumps, and the same pump can prime the dredging pump by using a hydraulic ejector.

The dredging pumps are single suction and preferably direct connected to their motors or engines. If this is not practicable on account of a great difference in speed of pump and driver, some means of reducing the driver speed has to be employed. The best is the silent chain drive, the spur gear reduction coming next and rope drive or belt coming last.

Motors for dredging pumps should be slip ring induction motors with 30 per cent speed control and of sufficient size to take the load which would be thrown upon it if the discharge line should break, as this would be the maximum load on the pump.

Table 1 shows the theoretical gallons per minute which will flow from nozzles 1½ inch to 5 inches diameter under pressures of 100 to 190 pounds per square inch, which are the pressures commonly used. It also shows the water horse power required. In order to get the brake horse power, it is necessary to divide the water horse power, the lower figure in each case, by the efficiency of the pump providing the pressure water.

The velocity of flow of water in the

*Vice President, Randolph Perkins Co.
Associate Editor, Pit and Quarry

Table I

U. S. Gallons Per Minute and Water H. P.

Lbs. per Sq. In.	Feet Head	Nozzle Sizes								
		1½"	1¾"	2"	2½"	3"	3½"	4"	4½"	5"
100	231	675	915	1190	1870	2870	3660	4780	6040	7460
		39	54	70	109	167	218	278	352	435
105	242	690	935	1220	1910	2940	3750	4900	6180	7640
		42	57	75	117	180	229	300	378	467
110	254	705	960	1250	1960	3010	3840	5020	6340	7830
		45	62	80	125	193	246	322	406	502
115	266	720	980	1280	2000	3080	3930	5140	6480	8000
		49	66	86	134	207	264	344	435	538
120	277	735	1000	1305	2040	3140	4020	5240	6600	8170
		52	70	91	143	220	280	366	460	570
125	289	750	1020	1330	2080	3220	4110	5360	6770	8360
		55	75	97	152	234	300	391	495	610
130	300	765	1040	1360	2120	3260	4170	5450	6890	8500
		58	79	103	161	248	316	414	523	645
135	312	780	1060	1390	2160	3340	4250	5550	7010	8670
		62	84	110	170	264	335	437	552	685
140	324	795	1080	1410	2200	3400	4340	5660	7150	8850
		65	89	116	180	279	356	455	586	725
145	336	810	1100	1430	2240	3460	4400	5760	7280	9000
		69	94	123	190	294	374	490	618	765
150	348	825	1120	1450	2280	3520	4500	5850	7400	9160
		73	99	127	200	310	396	515	650	805
155	359	840	1140	1470	2320	3580	4550	5950	7525	
		77	104	134	211	326	414	540	685	
160	370	850	1160	1500	2360	3640	4640	6050		
		80	109	140	221	340	434	565		
165	382	860	1180	1530	2400	3690	4700			
		83	114	148	232	356	454			
170	393	875	1200	1560	2430	3740				
		87	119	155	241	371				
175	405	890	1210	1580	2460					
		92	124	162	252					
180	416	905	1225	1600						
		96	129	169						
185	428	915	1240							
		99	134							
190	440	930								
		104								

The water horsepower—the lower figure in the table—must be divided by the efficiency of the pump to obtain the brake or motor horse power

pressure pipes should be very low so as to conserve as much head as possible for the nozzle. Thus, where 10 to 12 feet per second velocity is correct in the dredging pipe, it would be excessive in the pressure line.

Table 2 shows the loss of head in feet per 100 feet of pipe in carrying the quantities of water indicated. For instance, 2000 gallons per minute through a 10 inch pipe would use up 2½ feet per 100 feet of pipe, as against 1/10th foot for the 20 inch pipe, the friction being in the ratio of 25 to 1.

The problem of bringing the mix-

Table III

Grades of Sluices and Flumes

Per Cent of Slope	Degrees	Feet Per Mile	Inches Per Ft. to Nearest 1/16"
3½	2°2′	185	3/16
4	2°18′	211	1/2
4½	2°35′	237	9/16
5	2°52′	264	5/8
6	3°25′	317	11/16
7	4°	370	13/16
8	4°35′	422	15/16
9	5°10′	475	1 1/16
10	5°45′	528	1 1/8

Table II

Pressure Line

Loss of Head In Feet Per 100 Ft. of Pipe

Velocity 2 to 10 ft. per sec.

G.P.M.	PIPE DIAMETERS					
	10"	12"	15"	18"	20"	24"
500	.209					
1000	.715	.31				
1500	1.514	.825	.228			
2000	2.554	1.07	.377	.166	.103	
2500		1.63	.575	.246	.153	
3000		2.30	.80	.343	.211	.093
3500		3.10	1.06	.452	.28	.124
4000			1.35	.575	.352	.153
4500			1.69	.713	.438	.189
5000			2.08	.872	.536	.229
5500			2.46	1.04	.635	.272
6000				1.22	.744	.317
6500				1.43	.866	.370
7000				1.63	.99	.423
7500				1.86	1.13	.478
8000				2.07	1.27	.54
8500					1.43	.606
9000					1.59	.666
9500					1.78	.745
10000						.815

ture of water and solids from the bank face to the dredge pump section is a most important one as it fixes the location of the dredging pump and the frequency with which it has to be moved.

It will be seen from Table 4 that the quantity of water flowing, and therefore, the depth, in ground sluices has a great effect on the velocity. For instance, if a ground sluice 3 feet wide is carrying a depth of 3 inches of water, the velocity is 2 feet per second. If the water is 15 inches deep, the velocity is 5.25 feet per second. The second velocity would carry material which the first would not.

This brings us to the method, which

Table IV

Velocity and Volume of Flow

In Ground Sluices with Flash Boards

Width of Flume in Feet	Depth of Water in Feet	Coef. of Roughness	Slope Per Cent	Velocity Feet Per Second	Cubic Feet Per Second	Gallons Per Minute
B	D	N	S	V	C.F.S.	G.P.M.
3'	3"	.030	.025	2.0	1.5	675
	6"			3.24	4.85	2180
	9"			4.1	9.25	4150
	12"			4.85	14.5	6500
	15"			5.25	19.8	8900
3'	6"	.030	.04	4.15	6.22	2800
	9"			5.22	11.7	5250
	12"			5.92	17.7	7950
3'	6"	.030	.06	5.05	7.56	3400
	9"			6.4	14.4	6500
	12"			7.3	21.9	9850
3'	6"	.030	.08	5.83	8.75	3900
	9"			7.41	16.7	7500
	12"			8.35	25.	11200
3'	6"	.030	.10	6.55	9.9	4430
	9"			8.25	18.5	8300
	12"			9.4	28.2	12300

is often employed on one gun operations, of supplementing the water from the gun by water at low pressure which will increase the flow to the sump, thus increasing the velocity sufficiently to carry the solids effectively without greatly increasing the pumping cost.

On operations where several guns are in use, the flow from them can be brought together thus providing good volume and velocity.

Table V

Velocity and Volume of Flow In Wood Flumes

Width of Flume in Feet	Depth of Water in Feet	Coefficient of Roughness	Slope Per Cent	Velocity in Feet Per Second	Cubic Feet per Second	Gallons Per Minute
B	D	N	S	V	C.F.S.	G.P.M.
Unplaned continuous board flume carrying clear water						
1.5	.75	.012	.015	8.07	9.05	4050
			.025	10.2	11.45	5150
			.035	12.1	13.6	6100
2	1	.012	.015	10	20	9000
			.025	12.6	25.2	11300
			.035	14.85	29.6	13250
Unplaned continuous board flumes carrying 10% solids						
1.5	.75	.021	.015	4.	4.5	2020
			.025	5.05	5.65	2540
			.035	5.98	6.7	3000
			.04	6.4	7.17	3200
			.06	7.8	8.75	3930
			.08	9.	10.1	4500
			.10	10.1	11.3	5100
2	1	.021	.015	5.02	10.04	4500
			.025	6.35	12.7	5700
			.035	7.5	15.	6750
			.04	8.1	16.2	7300
			.06	9.8	19.6	8800
			.08	11.3	22.6	10100
			.10	12.7	25.4	11400

Pennsylvania Bulletins

Three new bulletins are reported ready for distribution by the Pennsylvania Pump Compressor Company, of Easton, Pa.

Bulletin No. 122, on Pennsylvania Aftercoolers, contains a lengthy and valuable discussion of the subject, illustrated with engravings, and also containing a table of sizes, capacities and weights.

Bulletin No. 123, deseribes Pennsylvania Air Compressors and Vacuum Pumps—Straight Line, Single Stage, Double Acting Types. "An important feature of our Compressor construction," say the manufacturers, "which is fully described in Bulletin No. 123, is the Pennsylvania Eclipse cushion ring plate valve. This valve—simple in design, efficient in service, remarkably quiet in operation, and of long life, will commend itself to all compressor users.

Bulletin No. 124, describes Pennsylvania Portable Air Compressors. The outstanding features of these compressors are the opposed cylinder type of construction, which is said to reduce vibration to a minimum. Reliability of service and ease in starting are other qualities claimed. By means of the disconnecting clutch with which the compressor is provided the engine may be run alone, to warm it up, before throwing on the compressor.

Chicago Change

The firm of Beck & Babb, John G. Beck and Miles T. Babb, who have been Sales Agents at Chicago for the Western Wheeled Scraper Company, has been dissolved. Mr. Beck has retired to go into business in Pittsburgh. The Chicago business hereafter will be conducted as the Earth and Rock Equipment Company, of which Miles T. Babb is manager and Bruce P. Smith, assistant. Mr. Beck made a host of friends in the equipment field who will wish him success in whatever he undertakes.

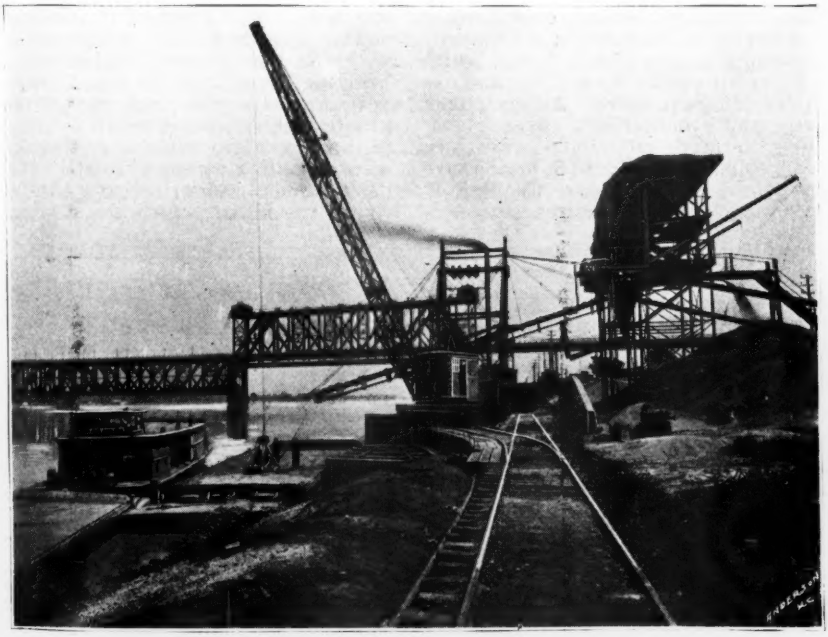
Modern Hydraulic Methods Produce Famous Classified Sand

Stewart Sand Company Exemplifies Modern Management Practice. Most Elaborate Layout of Service Facilities Maintained

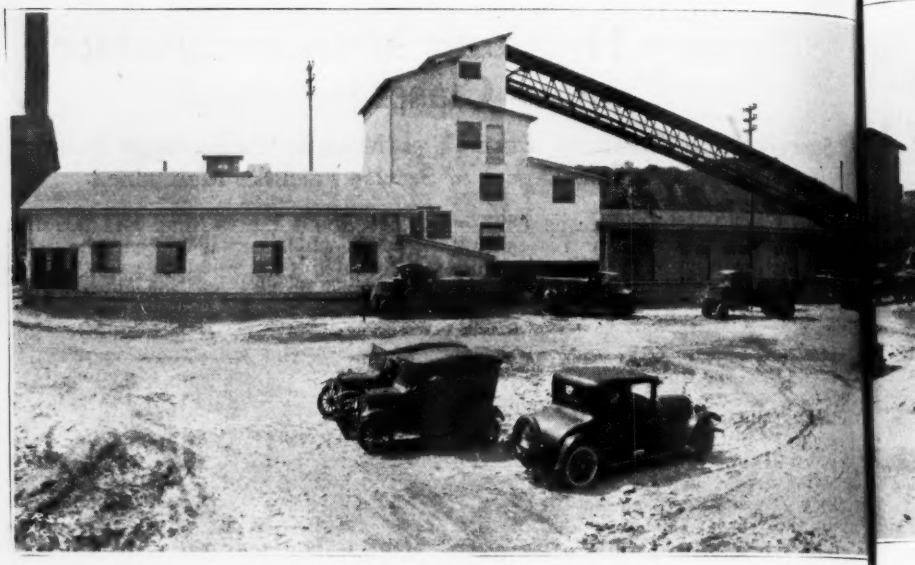
CONDITIONS in Kansas City, as they relate to the non-metallic industries, are brought very forcibly to your attention when you drop off there for only a few hours between trains. Almost before getting your bearings in this city, you will be attracted by the numerous trucks, which are spick-and-span and clean, and busy, bearing the name "Stewart Sand Company." Upon investigation you find that this fleet of trucks, numbering 60, are only a part of the facilities for serving the retail trade in Kansas City, Missouri, and Kansas City, Kansas, with sand, ready mixed mortar, plaster and building material supplies from 7 retail yards owned and operated by the Stewart Sand Company. The next thing that will attract your attention will be the standard gauge gondola railroad cars scattered rather indiscriminately throughout the railroad and terminal yards, which cars also bear the name of the Stewart Sand Company.

Being of the old school you may have been taught that where there is smoke there is generally fire, and therefore you will waste no time in looking up the base of operations. Upon making inquiry at the office of this company you will find that its president is none other than John Prince, President of the National Sand and Gravel Association. This one thing, probably more than any other you will agree, is the reason for the aggressiveness and business-like appearance of the entire Stewart Sand Company's operation and personnel which operation and personnel fairly bristle with the characteristics of John Prince himself.

Service, facilities for rendering service, consolidation or mergers and



Unloading Plant at the Foot of Grand Avenue, Kansas City, Missouri

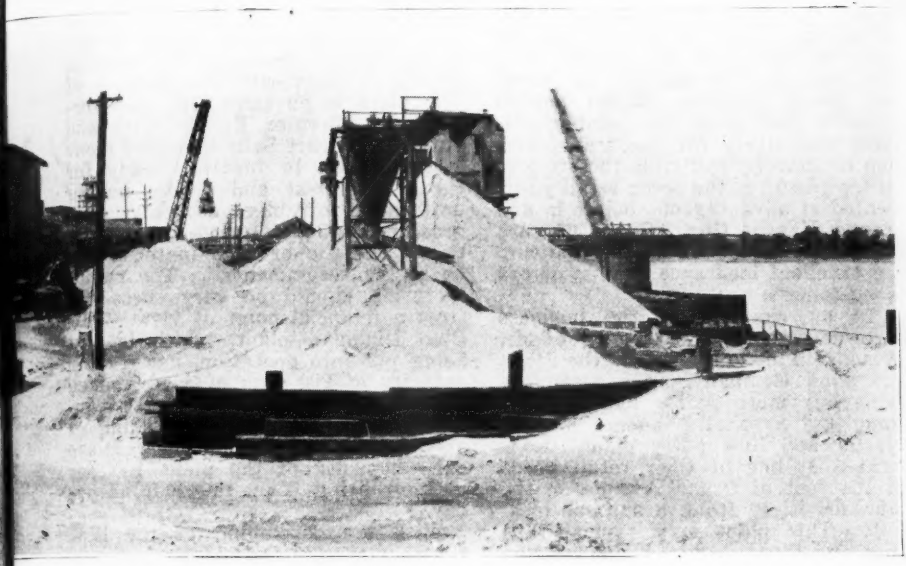


New Mortar and Lime Putty

the achievement of more sales seem to be the slogans of the Stewart Sand Company organization. It was only recently that this company took over the two sand plants of the Kaw River Sand Company, which consolidation now gives the Stewart Sand Company six sand pumping plants, five of which are located on the Kaw River and one on the Missouri River. All six plants have rail connections, four plants being located on steam railroads, while plants Numbers 8 and 9 are served by the Kansas City, Kaw Valley and Western Railroad, an electric line operating between Kansas City and Topeka. These six sand plants have a daily capacity of 125 cars, not just sand, but "Stewart Classified Sand," as it is termed by the company and known to the trade.

This classified sand, which is sand with the "guess work" taken out, is bringing from 75 to 85 cents per ton f. o. b. cars at the plant sites, or approximately $1.30 per ton f. o. b. cars in Kansas City, while less than car loads is selling at approximately $1.35 per ton plus truck or delivery charges. Asphalt sand of which the company

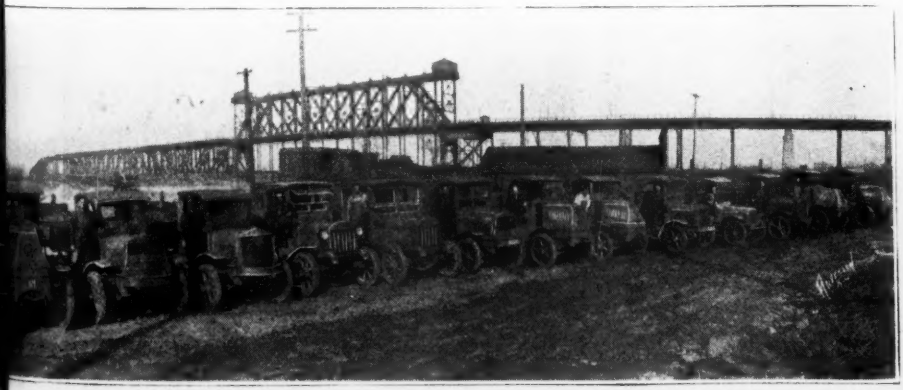
Truck Fleet of Stewart Sand



Plant and One of the Retail Yards

has an abundant supply is selling for approximately 85 cents per ton f. o. b. the plant sites. Sand exclusively is produced at all six pumping plants, and no attempt is made to produce gravel, the percentage of which is very small. Electricity as power is used almost exclusively at all sand plants, and of the fleet of sand boats being operated, only two are not electrically driven, one using steam and the other using oil engines. Each sand plant is adequately provided with stationary derricks or cranes for stock piling or storage, and in most instances this equipment is electrically operated. In fact, this company is supplanting other forms of power with electricity as speedily as possible.

The Stewart Sand Company has come to recognize that the best material in the world is useless to the builder until it is placed where he can use it. They therefore maintain, and they claim, the most elaborate layout of service facilities in that part of the country. Their claim certainly seems to be well grounded. Aside from 60 trucks, some of which are equipped with special water tight



Company for Local Delivery

bodies and specially constructed tops to prevent spilling or slopping of ready mixed mortar and plaster, they own, operate and maintain 65 standard gauge gondola 100,000 pounds capacity cars which are used practically exclusively for the transportation of sand by rail from the six producing plants to the seven retail yards located at advantageous points in and around Kansas City. These 65 cars owned and controlled by the company are excellent insurance against delays to customers.

As an example of the business shrewdness and aggressiveness of Mr. Prince and his organization, the Stewart Sand Company, as a means of achieving more sales, has recently completed a strictly modern mortar, plaster and lime putty plant. It is located at one of their retail yards at the foot of Grand Avenue on the Missouri River front, a suitable location. This plant is a typical Blue Diamond Plant designed and built by Blue Diamond Engineers at a cost of $100,000.00. It is as complete in every detail for the furnishing of ready mixed brick mortar, wet plaster and lime putty under the patented Blue Diamond process as are similar Blue Diamond plants located in Atlanta, Dallas, Cleveland, Philadelphia, Boston or Montreal. The building of this plant is an important step forward for Greater Kansas City and puts the Stewart Sand Company alone in a position to furnish "ready for the job" mortar and plaster having uniformity of mix, economy and greater production speed in construction. The use of such material can be highly recommended. The manufacturing should be very successful from a financial point of view. This Blue Diamond plant, which is just being put into operation, has a daily capacity of 200 tons of ready mixed mortar and plaster. It is so constructed as to permit the adding of another unit which would increase the daily capacity of the plant 100 per cent, or bring it up to 400 tons per day.

With the developing of the Blue Diamond mortar and plaster business, the Stewart Sand Company has found it advisable, if not a necessity, to enter the general building material field. While they are feeling their way into this new field, it appears

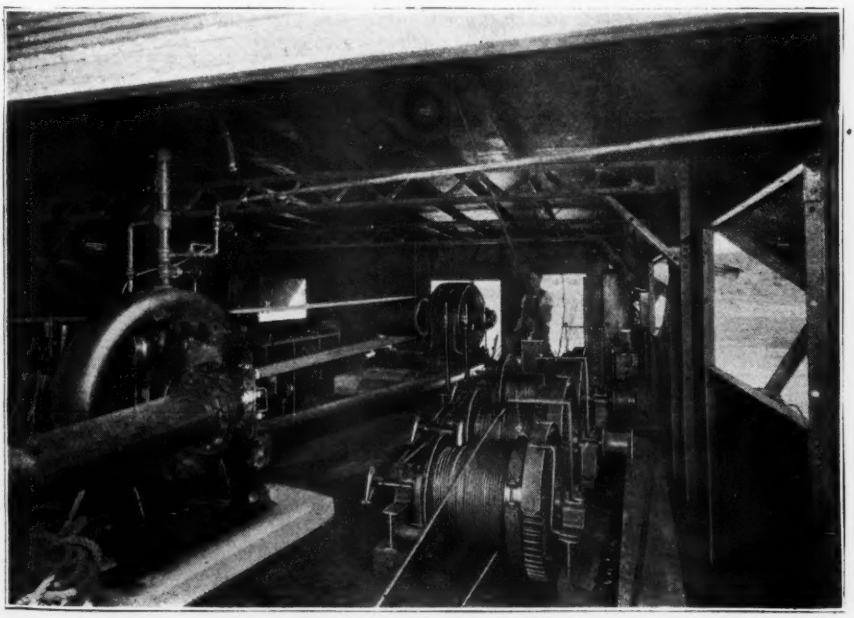
Booster Pump and Dewatering Cone at Plant Number at Sirridge, Kansas

that, owing to their facilities such as retail yard locations, delivery service and organization, it is only a question of a short time until the Stewart Sand Company will be not only the biggest producers and retailers of sand, ready mixed mortar and plaster, but also the biggest builders' material supply company operating in or around Greater Kansas City.

The quarry and crushed stone business in this locality, especially in Kansas City proper, has not had the development that is so noticeable in kindred lines, such as the sand and building supply business. The many small quarry operators, with which Kansas City has always been supplied, are seemingly content to operate independently on the old basis, resorting to almost any means of getting business. It is probable that this condition will always exist owing to the fact that a quarry location can be found almost any place. Even now some plants are located in the heart of the city, and the condition will continue unless it is controlled by some legislation on the part of the city.

It is possible that Mr. Prince has an eye on the quarry industry. If so, it will be of benefit to the industry in this locality. He is interested in the Kansas City Quarries Company which has offices in Kansas City. It has two operations, one at Rosedale, Kansas, on the Frisco Railroad, and one at Leeds, Missouri, on the Kansas City Southern and the Rock Island Railroads. Both of these plants are within six miles of Kansas City. Mr. Fred Johnson, who is president of the Kansas City Quarries Company, states that none of their output comes into Kansas City owing to the chaotic price conditions and selling practices of the local producers. Although quarry operating conditions are anything but ideal in this locality and the production of crushed stone is expensive, this company with a capacity of 20 cars a day from its two plants is finding a ready market at a price of approximately $1.80 per ton f. o. b. cars at their plants. It is interesting to know that the Missouri highway Commission are paying this price for stone notwithstanding their investments in the quarry business and their publicity of late about being able to produce stone in this locality for $1.25.

The Rosedale quarry of the Kansas City Quarries Company is a steam shovel proposition, the crushing plant proper consisting of one Number 8,



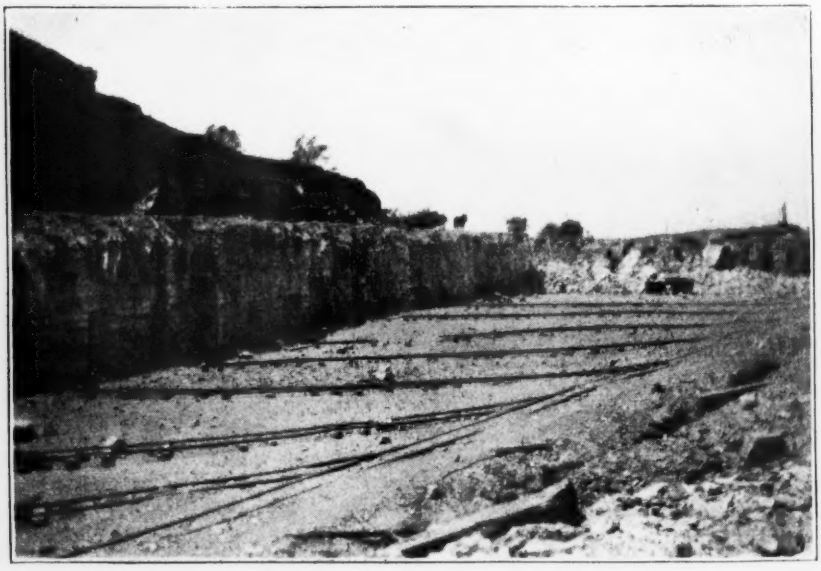
Interior of the Number 11 All Steel Dredge

one Number 5 and a 26 inch Symons Disc crusher. At the present time they are working a 40 foot face of stone from which they removed about 8 feet of overburden. The Leeds quarry of this company is a hand proposition owing to the fact that 6 feet of shale lies between the two ledges of stone. At this quarry the face is composed of first, 10 feet of stripping; second, 14 feet of what is called the winter set ledge of stone; third, 6 feet of shale and fourth, 20 feet of Bethany Falls ledge of stone. This Bethany Falls ledge is considered the best stone in this locality, and the ledge from which the Missouri Highway Department wanted stone for state highway use.

You will not be around Kansas City very long without hearing of some of the trials and tribulations of the Missouri Highway Department debut into the quarry business. It seems that to get the price of crushed stone in this locality down to a price that they thought reasonable, they financed a new quarry company in this locality with an amount of approximately a quarter of a million dollars. They were not experienced in the quarry business, and after building a modern up-to-date plant, they found that the stone from the quarry would not meet their own specifications. It is said that the company which was financed by the Highway Department has just completed a shaft some 200 feet in depth in an attempt to reach the Bethany Ledge of stone, which is within 30 feet of the surface at the Leeds Quarry of the Kansas City Quarries Company operation, and expects to mine stone similar to operations used in shaft coal mining. It would be an interesting and valuable story for the crushed stone industry, and doubtless a good lesson for Highway Departments in general to have the facts presented showing the Missouri Highway Department's role as a quarry operator and producer.

To sum up the impressions you would receive from a short visit in Kansas City, it seems that the material supply producers and dealers in and around Kansas City are experiencing 100 per cent business at good prices, and from all indications these conditions will exist for some time due to the fact that building activities continne to grow in Kansas City. They are not a boom or mushroom growth, but are a healhty, steady development of what seems to be a comprehensive program. The railroads in this vicinity are doing considerable construction work, and the city will impress you with its very diversified building activities.

The two plants which were formerly operated by the Kaw River Sand



The Rosedale Quarry Showing 40 Foot Face

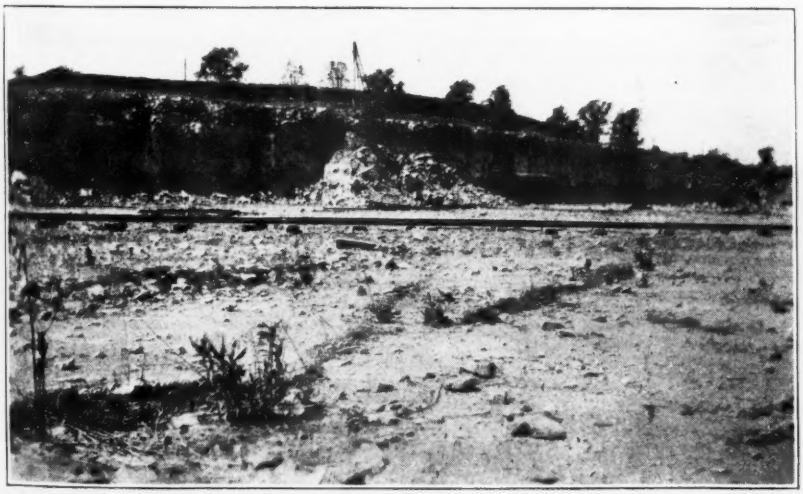
Company are both on the Kaw River. One of the two plants is down the river from the main operations and consists of one unit, a rotary cutter suction pump driven by an Anderson oil engine of 225 H.P. and located on a steel hull. The discharge pipes are supported on pontoons and the material is delivered to a tipple. Sand is loaded directly into railroad cars from this tipple. The storage capacity at this plant is about 25,000 tons.

The second of these two plants is located about a mile up the river from the first plant. This plant consists of two units. The first unit consists of a rotary cutter suction pump driven by a Fairbanks Morse diesel engine of 200 H.P. The discharge pipes are supported on pontoons, and the material is discharged to a tipple on the river bank. Sand is loaded from this tipple directly into cars. The second unit of this plant has a steam pumping barge with an Ideal engine of 160 H.P. This barge is towed up the river to any desired location and anchored. Sand barges each of 70 yards capacity are loaded and towed down the river to the permanent plant where they are unloaded by a special Clyde crane. The towing is done by a stern wheel tow-boat equipped with a Kalenberg 50 H.P. engine.

The Clyde crane, which is used for unloading, is equipped with a 3 yard clamshell. It travels on a reinforced concrete trestle 200 feet long which is supported on cypress piling. This trestle is designed to carry an axle load of 55,000 pounds which is the weight of the Clyde crane when in motion. The crane consists of an all steel A frame stiffleg derrick mounted on an all steel car. This derrick is equipped with an 80 foot steel boom and a 30 foot mast. The boom is swung by a Clyde 6¼ x 8 single drum, reversing, independent swinging engine. The car on which the crane is mounted is 45 feet in length and 24 feet in width. This car travels on two double flanged car wheels operating on a track 22 feet centers.

In some cases on the Kaw River where the distance from the boat to the classifying plant becomes too great and the head against which the dredge works becomes too high, the Stewart Sand Company has found it necessary to install a booster pump and dewatering cone. This is the case at the Number Nine plant which is located about 12 miles from Kansas City on the Kaw River.

The dredge at this plant is equipped with a 10 inch Amsco pump, which is belt connected to a 300 H.P. General Electric motor. A Lidgerwood 3 drum electric hoist is mounted on the dredge. Changes in speed can be made to conform with the length of the conveying pipe by merely changing pulleys. The dredge pump delivers the material to a dewatering cone on the shore, and a booster pump delivers the material from this cone to the sand classifying plant on top of hill.



The Leed's Quarry

The sand and water are pumped from the river and discharged over screens located over the dewatering cone on the shore. The foreign matter is returned to the river, and the excess water is discharged over the top of the cone and also returned to the river. The sand and water for the booster pump is released from the bottom of the cone by automatic valves. The suction of the pump is located about three feet above the apex of the cone. The booster pump is a 10 inch Amsco, and it is belt connected to a 200 H.P. General Electric motor. The pump, which is run at 530 R.P.M., works against a head of 92 feet.

The classifying plant to which the booster pump discharges is located on the Kaw Valley Electric Railroad. The pipe line from the short dewatering cone to the classifying plant crosses the main line of the Union Pacific and a main highway. This is accomplished by a large drainage tunnel without going above either the railroad or the highway. The clasifying plant consists of a 14 foot dewatering cone and two Allen sand classifiers. The plant is built upon a steel structure with concrete footings. The dewatering cone receives the material and partially dewaters it, thus providing a uniform feed to the Allen classifiers. The classified and dewatered sand is loaded directly into cars or discharged to a storage pile by means of swinging launders from the Allen tanks. The overflow from the classifying plant is discharged as waste.

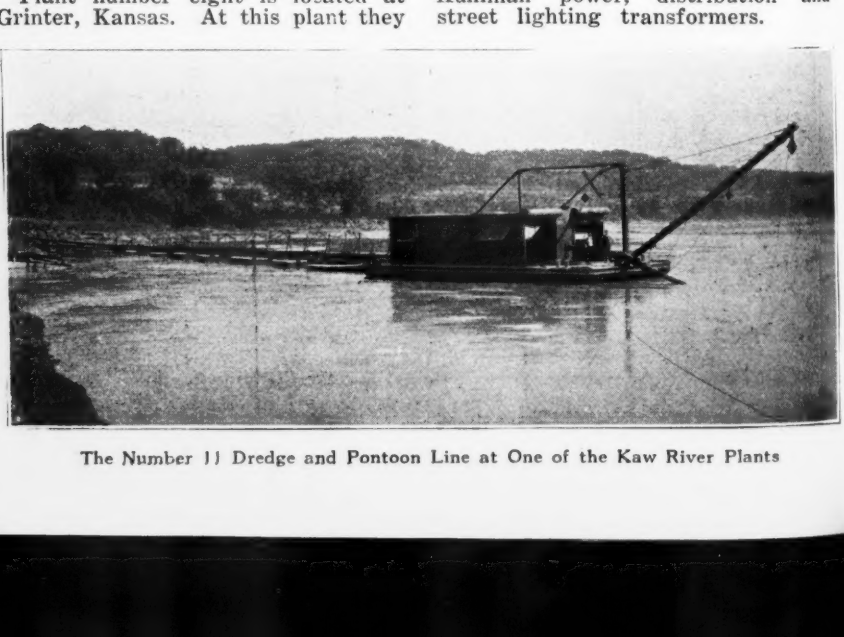
Plant number eight is located at Grinter, Kansas. At this plant they pump through 650 feet of 10 inch pipe from the river to the classifying plant. The elevation of the washing plant is 65 feet above the river. Dull cones, Allen tanks and Amsco pump are used. Storage for 25,000 cubic yards is provided at this plant. A full swing derrick operated by a Lidgerwood electric hoist reclaims the material with a 3 yard bucket.

Another plant is located about 5 miles from the mouth of the Kaw River. Here three Allen cones are being used. The sand is pumped by a Morris centrifugal pump which is connected to a 300 H.P. General Electric motor.

A plant is operated also on the Missouri River. The sand is dredged by a steam dredge onto barges which are towed by a gasoline tow boat to a dock at the foot of Grand Avenue, Kansas City, Missouri. The sand is unloaded from the dock by an electrically operated locomotive crane and discharged directly into the classifying plant.

A study of the Stewart Sand Company is an inspiration. They are one of the few sand companies in the industry who have applied engineering to the production of sand, and modern business methods to its distribution.

The Kuhlman Electric Company of Bay City, Michigan, has appointed the Stevens Sales Company of 134 West Second South Street, Salt Lake City, Utah, as district representatives for the state of Utah and parts of Idaho and Nevada adjacent to Utah. The Stevens Sales Company will handle Kuhlman power, distribution and street lighting transformers.



The Number 11 Dredge and Pontoon Line at One of the Kaw River Plants

Analyzing Freight Rate Problems In The Non-Metallic Industries

Written Expressly for Pit and Quarry by L. E. Whitney

THIS is the second of a series of articles by Mr. Whitney, who is a member of the firm of Gorman and Whitney, traffic advisers, who are conducting a special investigation for Pit and Quarry in certain freight rate matters as they pertain to conditions in the non-metallic industries.

Freight rates have such a bearing upon the market for products in the non-metallic industry that a careful analysis and exposure of some of the inconsistencies as they actually exist will be of interest to our readers. Freight hauls are usually short in our industry so that adjustments are peculiarly local. There is a rate relationship however and some of the conditions to be described by Mr. Whitney as existing in a certain territory may also exist in yours.

Readers are urged to send to Pit and Quarry any freight rate problems and Mr. Whitney will analyze the problem and make his recommendations. It may be that you want to know if your rates are in line. Any and all problems submitted will be dealt with expeditiously.

Editor.

The Interstate Commerce Commission is the tribunal of last resort where controversies between carriers and shippers involving freight rates may be submitted for final disposition. All evidence touching the particular adjustment in freight rates is given careful analysis, and the findings of the Commission, and the final order based thereon, become precedents for the guidance of shippers and carriers in future rate adjustment proposals. An examination of various cases decided by the Commission, therefore, is important as disclosing the elements which should be considered in determining whether or not a particular shipper or an industry is enjoying an entirely equitable adjustment in freight rates.

In the various cases involving rates on silica sand, the Commission has recognized certain fundamental facts which distinguish this commodity from the standpoint of freight rates from other grades of sand, particularly common or building sand. In Silica Sand Producers Association vs. Director General, a case involving complaint on silica sand rates from Ottowa producing group to points east of the Illinois-Indiana state line, the Commission made the following observations:

That silica sand in special grades of the prepared product sold as high as $6.00 per ton, while bank sand or run of mine from the same district sold for about $0.75 per ton; common sand is used in mortar, plaster and concrete, while silica sand, because of its purity, is used in the manufacture of glass; it is also used as an abrasive and, on account of its refractory qualities, in molds for the better grades of metal castings; silica sand ordinarily requires box cars practically as good as are used in the transportation of grain, and notwithstanding this, claims against the carriers for losses in transit are large; that the eastward movement of common sand provided loaded movement of gondola cars that would otherwise be returned to the mines empty.

The above findings of the Commission clearly show that the value of the commodity, the character of equipment required for shipment, the direction and amount of tonnage moved, the extent of competition with other similar commodities, and the rates applicable on such competitive commodities have been judicially determined to be important elements in the consideration of the reasonableness of any freight rate.

It is not the intention of the writer to give the impression that he believes that a shipper should always take his difficulties in freight transportation matters to the Interstate Commerce Commission for adjudication, at least in the first instance. That body should be appealed to only after every effort at satisfactory adjustment has been exhausted with the carriers. A very large number of cases brought to the Commission do not give a shipper the relief he may feel himself entitled to.

The relationship of one commodity

times has an important bearing in freight rate matters as, for instance, the relative loading and value of crushed stone, sand and gravel. In Waukesha Lime & Stone Company vs. C. M. & St. P. Ry., the Commission found, "As crushed stone has about twice the value of sand and gravel, and does not load quite so heavily, a rate on that commodity slightly higher than on sand and gravel would seem to be justified." In its final disposition of this case, the Commission found that rates on crushed stone should be 5 cents per ton higher than on sand and gravel on shipments from Waukesha, Wisconsin to Chicago.

Frequently a shipper is operating at a handicap through excessive charges exacted by the carriers for switching service, or in allowances to competing shippers for switching service performed by such shipper while denying such an allowance to another. In Westport Stone Company, et al, vs. C. C. C. & St. L. the evidence showed that the Big Four performed the switching service without extra charge over the line haul rates from quarries at St. Paul and Greeley, Indiana, while it refused to perform a similar service for complainants located at West Port and Newpoint, Indiana, and refused to make an allowance to complainants for performing such switch service with their own power. The competing plants were within a 20 miles radius of a common point, and it was developed in the testimony that the products of all quarries were of the same kind and in competition with each other for sale in the same territory.

In its final decision the Commission found that the distinction between these quarries by the Big Four was unuduly prejudicial to complainants, and the refusal of the Big Four to make an allowance to complainants of $1.00 per car for performing this service was unreasonable. Reparation to the extent of $1.00 per car was awarded complainants.

If operators are competing for business in a common territory under substantially similar circumstances, the carriers are obliged under the law to extend equal services to all, and on the same basis. This is true whether such treatment involves matters of freight rates, switching demurrage, car supply, or any other service necessary to the distribution of a shipper's products. There can be no doubt that many shippers in the non-metallic industry are today carrying burdens in their freight transportation costs that can be eliminated.

It has been the writer's observations that the carriers are, as a rule, governed by men of sufficient vision to realize that it is only as the interests of the shippers on their rails are best served than an enhanced and profitable tonnage can be produced and maintained. But, until shippers analyze their transportation problems for themselves and bring to the executives of the railroads serving them intelligent and constructive ideas regarding their freight traffic problems, they can hardly expect to secure relief.

Every shipper's operations involve problems distinctly peculiar to that operation, and it is impossible to lay down any general rule by which the traffic efficiency of a particular operation may be judged. Only a careful analysis of each individual freight distribution problem can disclose possible economies to be effected in transportation costs.

Jeffrey Belt Conveyors

In a new publication—Catalog No. 409,—The Jeffrey Manufacturing Company of Columbus, Ohio, presents a revised story of Jeffrey Belt Conveyors, illustrated with many halftone engravings.

These belt conveyors are described as being light in weight, simple in design and construction, silent in operation, and requiring a relatively small amount of power. They can be used to advantage for handling loose materials or packages, and may be installed on the horizontal or a moderate incline.

This book is published with the intention of showing some of the problems of conveying materials which have been successfully met by Jeffrey methods, also to make it as simple as possible to specify the right conveyor for each particular problem. These conveyors have been standardized and so indexed and classified that by referring to the tables one may determine the right conveyor to suit the need and order this Conveyor by its number. Tables of dimensions will enable architects and engineers to incorporate belt conveyors in their plans, and eliminate costly alterations after the building is completed.

Building A Modern Hydraulic Plant With the Future in Mind

Cape Girardeau Sand Company Completing New Efficient Plant. Possible Growth of Local Market Not Overlooked in Layout

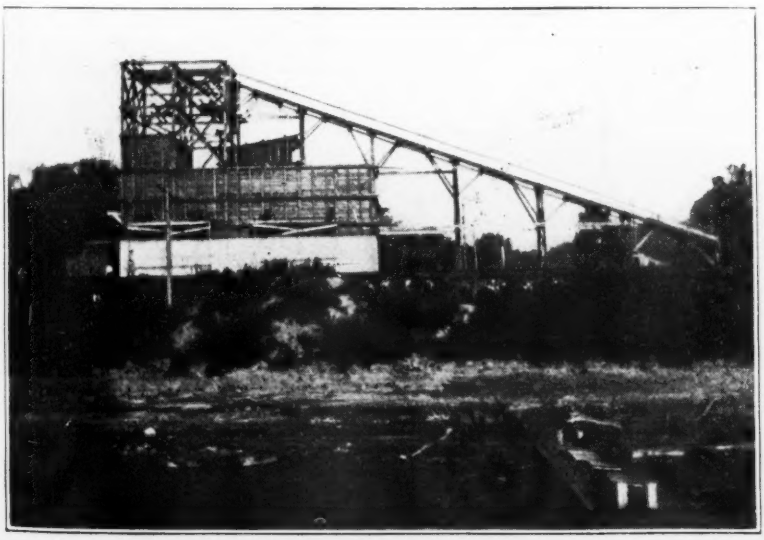
FORESIGHT played an active part in the plans of the Cape Girardeau Sand Company for the construction of its new sand and gravel plant on the Mississippi River at Cape Girardeau, Missouri. This plant which will have a capacity of one thousand tons per ten hour day is very efficient.

The plant site was purchased in September, 1924. The great possible local market was anticipated here because the location is between Main street, the St. Louis San Francisco Railroad and the Mississippi River. The location selected is, in fact, the most desirable to be had in Cape Girardeau. It is centrally located and on a paved street which makes it possible to deliver by motor trucks to all parts of the city. The delivery problem will never become acute as the city grows either as the city must continue to grow in all directions away from the plant. The site has a 245 foot frontage on Main street, and a northern boundary of 134 feet and a southern boundary of 117½ feet both on the Mississippi River. The accompanying illustrations show the available space for stocking material which will be an important asset in material distribution.

The plant was designed and the machinery furnished by the Stephens-Adamson Manufacturing Company. The conveying and screening machinery is all electrically driven. The sand and gravel will be pumped from the Mississippi River at a point about three miles upstream from the plant by a self propelled steam dredge.

The sand and gravel will be brought to the plant by barges each of 270 tons capacity. It will then be unloaded from the barge by a derrick boat, using a clamshell bucket of 1½ cubic yards capacity, into a receiving hopper located on the river bank near the plant.

A conveyor belt will carry the material from this hopper under the main line track of the Frisco, and also under the side track which leads to the plant, discharging the sand and gravel onto another belt which will deliver the material to the top of the bins. Here the material will be discharged into a Gilbert revolving screen. The coarse gravel, which is



Side View of Washing and Screening Plant

from ½ inch up to 2½ inches, will be discharged into the bin on the south end of the main structure. The smaller sized gravel, which is ¼ to ½ inch, will be discharged into a bin next to the larger sized gravel bin. The sand will all pass through perforations, ¼ inch in diameter, and will then be spouted to a sand classifier (a distance of about 15 feet), where it will be dewatered to a certain extent. The sand will be drawn from the classifier by means of an endless chain with buckets attached and discharged into the main sand bins which hold 300 tons.

The water from the classifier will be carried away in an overflow trough and pipe line which runs alongside the bin, and down the end of the bin to the ground. From here the water will be carried through a pipe to the river.

The water for washing the sand and gravel is secured from the Mississippi River by an American Well Works centrifugal pump which is driven by a 30 horse power General Electric motor. It is expected that approximately 600 gallons of water per minute will be required to wash the sand and gravel thoroughly.

An overhead belt conveyor will be installed to carry the sand from the classifier for a short distance from the main bins and to discharge it onto another conveyor that will run parallel to the space which will be used to stock sand for emergencies caused by high water or by breakdowns. This overhead conveyor will be so arranged that the sand can be discharged from the belt at any point. There is sufficient ground space to stock several thousand tons of material.

The bins are so located that railroad cars can be loaded from the east side by means of steel chutes while motor trucks can be loaded from the other side also by chutes. This will facilitate the handling of the sand and gravel without endangering the lives of the workmen who are employed at the plant and the truck drivers.

The Cape Girardeau Sand Company will develop its market in road building and building construction. Peter H. Deimund and Linder Deimund are both in active charge of all operations with one in charge of sales and the other in charge of production.

Stoker Bulletin

Detroit underfeed stokers of the single retort type are described in a new and very attractive 32 page bulletin just off the press. Among other items of outstanding interest to combustion engineers, the bulletin contains a number of fuel bed cross sections showing conditions of the fire with respect to air distribution and movement toward the dumps. One section of the book is devoted to the application of the stoker to both low and high set boilers. Another section shows how twin settings serve very large boilers.

Main Line of Railroad, Siding and Part of Storage Space

Blasting Practice in Quarry And Open Pit Mining

Written Expressly for Pit and Quarry, By R. N. Van Winkle

Part VI

This is the last of a series of articles on this subject by Mr. Van Winkle. The first appeared in the June first number of Pit and Quarry. In the first article Mr. Van Winkle discussed the action of explosives, kinds of explosives, selection of explosives and amount of explosives to use.

In the second article, which appeared in the June 15th number, the size of cartridges, explosive costs, and methods of figuring the shot were discussed.

In Part III drilling, locating and loading practice as applied to quarry and open pit mining were discussed.

In Part IV firing practice, the tunnel method and the benching method of blasting were discussed.

Readers are invited to correspond with Mr. Van Winkle in relation to these articles or to blasting problems in general. The editor of Pit and Quarry will be pleased to receive comments or data on this subject from readers whose experience and knowledge will be of value in the study of blasting practice.

Editor.

Posting of Property

Some states have very rigid laws governing the posting or marking of property where high explosives are stored or used. In some instances these laws are enforced to the letter. The marking or posting of property by conspicuous signs should be encouraged. As a rule these signs read, Explosives—Keep Off. While such a sign is satisfactory and covers the situation, the following sign is a little more elaborate and to the point.

DANGER
EXPLOSIVES
are being used on these premises
Trespassers enter at their own risk
CALL AT OFFICE

While the posting or marking of property may not save a law suit in case of injury, it cannot be shown that you were negligent, provided the property is properly marked with signs such as the above placed in conspicuous places.

Handling Complaints Resulting from Blasts

As far as the writer knows, little or no written information is available bearing on this subject; still many complaints and frequent court proceedings are the results of blasting operations. From experience and observation we know that complaints resulting from blasting as a rule can be traced to one or more of four reasons.

1. As a medium to force the quarry or open pit operator to buy the property which the blasting is claimed to be damaging.

2. As a means of closing the operation by real estate companies or individuals who have purchased land adjacent for plotting into new residential subdivisions.

3. As a means of collecting petty damage claims by unscrupulous property owners and residents.

4. Really tangible and just claims for damages sustained.

The method of approach in the defense of such claims is somewhat different in each case. The first case is unquestionably one for an attorney, and the defense can be strengthened materially by affidavits from friendly neighbors. This is also quite true in the second and possibly in the third case; but in the case of really tangible and just claims a prompt adjustment without recourse to attorneys or law has proved to be more satisfactory. Almost 95 per cent of the claims, whether legitimate or illegitimate, are traceable to concussions, and very few, if any, can be actually traced to earth tremors or vibrations caused by blasting in quarry and open pit mining. It is moreover questionable whether it can be proved that blasting as followed in quarry and open pit operations could set up tremors or vibrations sufficient to cause damage sometimes claimed. Irrespective of the motive or basis for claims or damages, only specific claims giving dates, time and details showing some connection with a blast should be considered. Gen-

eralities should not be dealt with. If adequate records are kept by the operator of blasts, showing time made, explosives used and conditions under which the blast is made, those records may readily disprove claims or serve as excellent evidence in court. Keeping of such records is to be encouraged. Quite often the damage claimed does not result from blasting, but is traceable to natural causes. For instance, in a building or structure it can be traced to settling, shrinkage, weathering or ordinary wear and tear, and in specific cases it has been shown conclusively that the vibrations caused by blasting developed less than 1/50 of the stress or strain which the materials would safely stand. Portable seismographs can be used in registering vibrations if one can be procured, and the records made by them are splendid evidence. Unbiased authorities and competitors engaged in similar operations are the best witnesses that can be obtained, however, provided the claims filed are unjust.

Glossary of Terms Used in Quarry and Open Pit Blasting

Annunciator
Used in connection with annunciator or bell wire, which means wire commonly used for electric annunciator or bell circuits.

Back Break
The term used to designate the ground cracked or opened up in the top of a solid face directly back of a line of drill or bore holes that have been previously shot, and caused from the previous shot.

Bank
Bank is a quarry term applied to back of a line of drill or bore quarried out.

Benching
A method of quarrying when the face is carried back in a series of benches resembling stair steps on a large scale. Steps are not always regular, but are regulated by advantageous seams in the face.

Black Powder
A granular explosive consisting of approximately 74 per cent potassium nitrate, 16 per cent wood charcoal and 10 per cent sulphur.

Blanket or Buffer Shooting
A term used to designate a practice of leaving along the quarry face stone from a previous blast, against which a subsequent shot is made preventing the rock from being thrown far from the source, also rendering the subsequent shot more effective.

Blast
The operation of blasting or rending rock or earth by means of explosives.

Bleeding
Bleeding in explosive work as a rule refers to leaking or losing of nitro-glycerin from a cartridge of explosives.

Block Holing
The term used for breaking large stone by discharging dynamite in shallow holes made by jackhammer drills. One fifth of the amount of explosive necessary for dobying or mud capping a stone will do the work satisfactorily if placed in block holes.

Blowout
A shot or blast where the force of the explosive goes out the top of the hole or through a seam or crevice and does not do the work for which it was intended. Blowouts are not only expensive, but dangerous.

Booster
A term used when a small amount of high explosives is attached to a detonator for the purpose of increasing the rate of detonation of a charge.

Bore Hole
Any hole made in material to be blasted by drilling with churn, jackhammer, tripod drill or by hand. This is often called the drill hole.

Brisance
A French term which when used in connection with high explosives or blasting operations means to shatter or break to pieces.

Broken Charge
A charge of explosives in a drill or bore hole divided into two or more parts and separated by stemming.

Burden
By burden is meant the distance between the bore holes or charge of explosive and the free face of material to be blasted.

Cartridge
A paper shell filled with dynamite or other high explosives and used for blasting purposes.

Chamber
The space made in the bottom of a drill hole by the springing method. This space is also referred to as pocket.

Collar
A term when used in connection with a bore or drill hole which means the top or mouth of the hole.

Column Loading
The distributing through the length of a hole the explosive, separated by stemming to distribute the shattering action over a greater area and where needed.

Connecting Wire
A wire generally of smaller diameter than the lead wire used in making connections between electric exploders in bore holes.

Contour
When used in connection with quarrying means the lay of the ground, whether the top of the bank is level or rough.

Cordeau
(The proper name being Cordeau-Bickford) is a detonating safety fuse consisting of a lead tube filled with Trinitrotoluene, which tube is very carefully drawn to uniform size. There is absolutely no danger in handling or storage of Cordeau-Bickford and the claims for its importance are safety, speed and increased efficiency of the explosive charge.

Coyote Hole
Sometimes called gopher hole. A term used for drilling a small tunnel horizontally into the rock at right angles to the face of the quarry from which there are two or more offsets drilled parallel with the face of the quarry into which the explosive charge is placed, while the rest of the tunnel is filled with broken rock, etc., to act as stemming.

Crest
Sometimes used in connection with the bank or face and means top or high point.

Crimper
A tool used for attaching an explosive cap to a piece of fuse.

Cross-Cuts
In the tunneling or coyote method of shooting it means the tunnels that are driven at right angles to the main tunnel and sometimes referred to as "T's."

Cutout Hole
A cutout hole is a drill or bore hole so spaced or located as to relieve excessive burden or spacing at either end of a shot. It is also used to relieve a tight situation in shooting operations.

Dart
A piece of wood sharpened at one end and made with a barb on it which is attached to a rope for lowering explosives into a deep hole.

Deck Loading
A term meaning the loading of explosives into the top or deck, like well drill holes in bank shooting.

Detonation
The sudden change of explosives from a solid or liquid form to gas accompanied by a sudden report.

Detonator
A copper cylinder filled about 1/3 or 1/2 its length with fulminate of mercury or some mixture of fulminate of mercury which when ignited produces a shock ample to set off a charge of explosive. It is usually referred to as a cap or exploder.

Disruptive
A term applied to that kind of force exerted by an explosive that tends to shatter the rock into fragments.

Displacement
When used as a quarry term means the cubic yards or tons of stone moved or shot out.

Dobying
A term meaning the same as mud-capping and is the placing for firing of an explosive charge on a big stone and covering it with mud or clay. This is a very expensive practice and should be resorted to only in an emergency.

Double Load
Double loading, sometimes referred to as column loading is a term applied to the practice of separating the charges of explosives by stemming for the purpose of better distribution of effects or for the prevention of blowouts at mud seams or crevices.

Exploder
A fulminating cartridge used to explode or detonate a charge of explosives, often referred to as a cap or detonator.

Face
By face is meant the surface exposed by excavation of the working front.

Fault
In geology, an imperfection, a break in the continuity of a body of rock.

Firing
By firing is meant the setting off or exploding of a blast. This can be done with fuse and cap, electric exploders or Cordeau. Electric firing is done with special batteries or from current taken from an electric line or dynamo.

Fuse
Ordinarily termed fuse, but known too as safety fuse, consists of a cotton or hemp tube holding a slow burning composition for exploding blasting caps. Different kinds of brands of fuse have different rates of burning, measured by seconds it takes one foot to burn.

Galvanometer
A pocket size metal case containing a small chloride of silver dry battery connected with 2 binding posts by coils of wire and equipped with a magnetic needle which moves across a dial on the face when a current is completed.

Ground
The word ground is often used to mean any material to be blasted such as earth, stone, ore, shale, coal or what not.

Gopher
A term sometimes given to the tunnel method of blasting.

Hang Fire
A charge of explosive which explodes later than expected. Hang fire rarely occurs with electric firing, but is not infrequent with blasting cap and fuse.

Hog Over
A term which refers to the practice of going over the top of a bank of stone that has been shot, selecting and plugging and blasting the ones too large to handle economically.

Hung Shot
A shot which does not explode immediately upon detonation or ignition and meaning practically the same as "Hang Fire."

Length of Shot
The size of the block of ground to be blasted measured parallel with the line of drill holes or face.

Low Freezing Dynamite
A dynamite so made that its freezing point is below that of such dynamites as contain only nitro-glycerin and an active base and which have a normal freezing point of about 45° F. Low-freezing dynamites do not freeze until temperatures below 32° F. are reached and even then only after prolonged exposure.

Low Grade
An arbitrary designation of dynamites of less strength than 40 per cent.

Low Powders
As a rule mean low strength but high explosives which are intermediate in their action between blasting powder and the dynamite. They are all detonating explosives and are made in 4 grades of strength: RRP; F; FF; and FFF.

Lines of Cleavage
The lines and direction in which stone or ground tend to divide.

L. F.
When used in connection with dynamite means Low Freezing. See definition for Low Freezing.

Misfires
When a charge of explosives supposedly properly placed and detonated fail to explode it is called a misfire. Sometimes when explosives burn, it is called a misfire.

Muck
The drill cuttings or surface dirt and water that get into a drill hole and which should be removed before loading the hole with explosives.

Mud Capping
The method of placing the charge of explosive on the top of rock to be broken and placing over it a cap or cover of mud to confine the action of the explosive.

Multiple Shot
A number of charges in drill holes, fired simultaneously with an electric current.

Opening Shot
The first bore hole fired in "blasting off a solid" to provide a space into which material from following shots may be thrown.

Parallel Connection
The term applied to the method of connecting the two wires of each electric exploder direct to

the lead wires; one wire of each exploder to each lead wire.

Parallel Series Connection
A term used where the series and parallel connections are combined, thus connecting each separate series in parallel with the two lead wires.

Plug
To drill with a jackhammer or air drill, large stone for secondary blasting. The air drill is often referred to as a plug drill and the operation of drilling with same is called plugging.

Pockets
When used in connection with tunnel blasting mean the pit or hole which is sunk below the cross cut floor to contain the charge of explosive.

Pocket Loading
The term used for placing the explosive charge at the chamber end of a drill or bore hole.

Powder Monkey
A term sometimes used in quarrying to designate the man in charge of the loading and handling of high explosives.

Primary
The initial or first shooting or fragmentation of the original bank of stone.

Primer
A high explosive cartridge with an electric blasting cap or other detonator inserted.

Propulsive
A term applied to the kind of force exerted by an explosive that tends to push out masses of rock rather than to break them up.

Renfort
A French term or word meaning "Booster."

Secondary
The second attempt to break ground or material for proper size to handle. The operation is called secondary to designate it from primary or first shooting.

Series Connections
A term used where one wire of each electric exploder is connected to one wire of the next or following exploder and so on, and connecting the two loose wires at the end of the series to the lead wires.

Short Leg
A shortened wire on a blasting cap or exploder for the purpose of preventing a short circuit by having the joints or connections come opposite each other.

Single Shot
A charge in one drill hole fired at one time as contrasted with a multiple shot where charges in a number of holes are fired at once.

Skewer
A wooden instrument which is attached to a rope or string and inserted in a cartridge deep enough so that it will hold when suspended and is used for lowering high explosives into drill or bore holes and by a quick jerk of the rope or string release the cartridge after same is properly placed.

Snake Holing
Is the drilling of holes with tripod or jackhammer drill almost horizontally at the base of the face and finds favor in hard massive formations having no particular lines of stratification or cleavage and in cases of where the stratas are on edge.

Spacing
The distance between drill holes, staggered or in a row.

Spent Shot
A blast hole that has been fired, but has not done its work.

Springing
A term meaning the enlargement of the bottom of a drill hole by exploding one or more small charges of explosives to enlarge and make room for a larger charge. In springing operations a strong, quick explosive is the best suited.

Squib
A slow burning tapered tube filled with fine gun powder which allows time for the firer to reach a place of safety after fuse has been lighted.

Staggered
The method of placing drill or bore holes ahead or behind other holes for the purpose of getting better fragmentation. A method very effective in many cases.

Stemming
Means the sand, clay, loam or screenings used in confining or holding in place the explosive charge.

Tamping
Ordinarily the word tamping means the act of ramming or packing into place the explosive

charge, but it is also used to designate the material such as sand, clay, loam or screenings used in confining the explosive charge. Good tamping is essential to successful blasting.

Toe

By toe is meant the burden of material between the bottom of the bore hole and the free face.

Tongs

A special device made for lowering high explosives into deep well drill or bore holes.

T's.

A term used in tunnel blasting meaning cross-cuts off a main tunnel and at right angles to the main tunnel.

Velocity

The rate at which any explosive detonates is commonly referred to as the rate of velocity and is usually expressed in feet per second.

Dont's

To be successful in the handling and use of explosives one must practice eternal vigilance and the writer gives below some of the "DONT'S" it will be well to follow religiously.

DON'T allow metal tools to remain around a drill or bore hole when loading dynamite. They may accidentally fall in the hole causing friction when tamping, resulting in an explosion.

DON'T store blasting caps or electric exploders in any but a good dry place.

DON'T use dynamite when cartridges or cases show evidence of extreme deterioration, such as bleeding or leaking.

DON'T allow loose dynamite or powder to accumulate around the mouth of a hole being loaded—the nails in the sole of a workers' shoes may cause sufficient friction to set it off. Cleanliness is important.

DON'T use electric caps or exploders with iron wires; it does not pay, use copper wires.

DON'T prime or connect charges of explosives for electric firing during the approach or progress of a thunder storm. If already primed keep everyone away until after the storm is over. Lightning has been known to detonate an explosive charge where electric exploders were used.

DON'T permit men loading dynamite in drill or bore hole to have friction matches on their persons. One may by accident be dropped in the hole with disastrous results.

DON'T let the temperature rise over 90° F. when thawing dynamite.

DON'T leave the ends of electric exploder wires exposed where holes are primed and must be left open over night—bury the ends of the wires in earth and take no chance of an electrical storm coming up and firing the blast.

DON'T use different makes of electric exploders in the same blast or shot. No two makes can be used together safely.

DON'T let heat come from below when thawing dynamite; let it come from the sides and ends or top, for in thawing, cartridges may bleed if permitted to get too hot, and the nitro-glycerin bleeding out may drop on the bottom which if hot might cause an explosion.

DON'T store explosives or accessories in cities, or other populated places except by compliance with all state laws or local regulations. If you do, you may regret it.

DON'T leave magazines or places where high explosives are stored unlocked at any time. It is dangerous practice.

DON'T allow anyone to enter explosive magazine whose business does not require it.

DON'T trust to inexperienced hands the use or handling of explosives.

DON'T permit loading of drill holes too near steam shovels or locomotives without overhead protection, as hot cinders or sparks may drop into hole causing an explosion.

DON'T return too quickly to investigate a misfire or failure of a charge to explode when using cap and fuse. Wait at least ½ hour.

DON'T load explosives into drill holes without first being positive that the hole is down to required depth and perfectly cleaned of muck and foreign matter.

DON'T store caps or electric blasting caps with other explosives.

DON'T jump at conclusions in the

handling and use of high explosives. Remember, slow but sure gets there safest in explosive work.

DON'T take men away and put new men on explosive loading operations, as it is bad policy. Start men and let them finish their job uninterrupted. It pays in the final result.

DON'T load another charge of explosives in a hole that has been previously sprung by using explosives until you are positive the hole has cooled off.

DON'T allow rubbish or dry leaves to accumulate around the outside of your explosive magazine. Such practice is conducive of fire.

DON'T face the sun when watching a blast, as the sun will prevent your seeing flying objects.

DON'T store dynamite in the back of your magazine and forget it, using the newer cases first. Always use up oldest dynamite first.

DON'T allow blaster to crimp caps with his teeth. Tools can be purchased for such operations and do the work better.

DON'T permit smoking around explosive magazine or when loading drill holes. It is a dangerous practice.

DON'T store miscellaneous material with caps, electric blasting caps or other explosives.

DON'T store high explosives in anything but a well ventilated, dry magazine, the walls of which are thick enough to be bullet proof.

DON'T use dynamite when chilled or frozen. It is expensive and a dangerous practice.

DON'T slit the paper covering on dynamite cartridges when water is present in drill or bore hole. It is not advisable.

DON'T cut fuse on a slant. Cut it straight across with a clean sharp blade.

DON'T make any loops or loose connections with wires when firing electrically. All joints and connections should be good electrical connections made with clean wire.

DON'T uncoil fuse while cold, as it may crack. Warm fuse to a temperature of 70° to 80° F. before attempting to unroll or uncoil it.

DON'T use grease in any form for waterproofing fuse as the oil will penetrate the outside wrapping and dampen the powder train.

DON'T fail when making connections with waterproof electric exploders or caps to scrape all the enamel as well as the insulation off the wires.

DON'T take chances in handling high explosives, for your fellow worker may have to suffer.

DON'T be afraid to operate a blasting battery with all possible force. It is made to stand it.

DON'T forget the nature of explosives. Also, remember that with proper care they can be handled with comparative safety.

DON'T leave explosives in a field or any place where stock can get at them. Cattle like the taste of soda and saltpetre in explosives, but the other ingredients probably would make them sick or kill them.

DON'T force a primer cartridge into a bore hole.

DON'T haul caps or electric detonators in the same wagon or truck used when hauling or teaming explosives through cities, towns or villages, it is the best policy to cover the entire load with a canvas or tarpaulin.

DON'T carry blasting caps or electric blasting caps in your pocket.

DON'T cut or break a high explosive cartridge while it is frozen and don't rub a cartridge of high explosives in the hands to complete thawing.

DON'T hurry in seeking an explanation for the failure of a charge to explode.

DON'T tap or otherwise investigate a blasting cap or electric blasting cap.

DON'T store fuse in a hot place, as it may dry out so that uncoiling will break it.

DON'T try to withdraw the wires from an electric blasting cap.

Conclusion

No phase of quarrying or open pit mining is more important than blasting, and often the success or failure of an entire operation is dependent upon this one branch. Owing to the fact that so great a range in formations and textures of stone or ground to be handled is encountered, it is impractical as well as impossible to formulate any set of rules to govern even the blasting or shooting problems at any individual quarry or open

pit, let alone to formulate any set of rules to govern all quarries and open pits. It has been the object to embody herein information that has actually proved by experience to be of practical value. While it is not claimed to be invulnerable to criticism, it is hoped that it will contribute in a small way to more safety, efficiency and economy in blasting operations in quarrying and open pit mining. Many operators who are greatly concerned about every penny lost in paying a workman, are unaware of the dollars sometimes lost through inefficiency in blasting. If the information given will awaken an interest in scientific blasting and the application of scientific principles and knowledge to blasting operations, its purpose will have been accomplished.

Haiss Publications

Two new publications have been issued by the Geo. Haiss Mfg. Co. of New York City. One is Catalog 425, on Haiss Buckets, the other a folder entitled "A Smashing Blow at Handling Costs."

Catalog 425 contains a comprehensive description of Haiss clam shell buckets for excavating and rehandling. "The outstanding requirement of a Clam Shell Bucket," says the introduction, "is that it shall 'stand the gaff.' It must be powerful enough to stay on the job all the time.—From the first Haiss has built buckets which users found were staying on the job longer and with less repairs than they even hoped."

Among the buckets described are: Power Wheel Buckets for Rehandling; Lever Arm Buckets for All-Around Use; "Hi-Power" Buckets for Excavation Work; Contractor Type Clam Shell Buckets; Type "FF" Clam Shell Buckets, Manure and Refuse Grapples, and Haiss Counterweight Holding Drum.

In "A Smashing Blow at Handling Costs," the advantages of Haiss-Fordson Loaders are set forth. The Model "FC" "Path Digging" Loader, for contractors and material yards, is described as a good light heavy loader; Model "FW" Truck Loader is for Sand, Coal and other Light Duty Work; "The Belted Champion" Portable Belt Conveyor is for Loading Loose Materials; the Haiss Creeper Model "Path Digging" Loader is for Heavy Duty Work.

Big Blast Hole Drills

A large new catalog has been issued by The Sanderson Cyclone Drill Co., of Orrville, Ohio, entitled "Cyclone Big Blast Hole Drills, and Their Applications to Qarrying, Open Pit Mining and Heavy Rock Excavation."

"The Big-Hole Method of Drilling for rock removing," says the Introduction, "is a Twentieth Century Development. In less than ten years it has revolutionized heavy open-cut rock excavation work. It has paved the way for the use of big machinery in quarrying, open-pit mining and contracting which have placed these industries on a scale whose hugeness otherwise would have been impossible. It has been the forerunner of many of the more important labor-saving practices in the production of stone and ore by the open-cut method."

In the quarry field, say the manufacturers, it was first thought that the big drills were suitable for only high breasts where the supposedly high drilling and explosive cost would be absorbed by savings in other ways. It was tried out, however, by operators of medium height quarries, and different systems of spacing and loading the drill holes evolved which eventually proved that well drills were successful on ledges of any height down to 25 feet, and even much lower breasts.

The claim is made that the actual cost of explosive itself, per unit of stone produced, has shown a saving with the big-hole method over the benching method except in isolated cases, and that stone is brought down in better condition.

The illustrations show the drill in all kinds of quarry operations, also a fleet of barge-mounted drills engaged in sub-acqueous drilling for U. S. Government engineers. Another shows a No. 14 Cyclone gasoline traction drill on the summit of a copper ore mountain in Arizona to which it had climbed under its own power.

The book describes, with the help of numerous illustrations, the various kinds of operations, methods of drilling, quantities of explosives to be used, operating and cost data, and tables of dimensions and specifications. The drills are also manufactured with steam traction and non traction.

Factors Governing Modern Lime Kiln Capacity and Fuel Economy

By Victor J. Azbe, Consulting Combustion Engineer

Part VI.

Part I of this paper appeared in the June first number of Pit and Quarry. Actual fuel lime ratios, heat distribution in theoretical kilns and kiln efficiency rating were discussed.

In Part II, which appeared in the June 15th number, effects of excess air on lime kiln efficiency, incomplete combustion, and heat loss by radiation were discussed.

In Part III, published in the July 1st number, kiln performance was discussed from gas analysis, and the results of kiln gas analysis tests were presented and discussed.

In Part IV, which appeared in the July 15th number, the reduction of kiln efficiency during the drawing period, the lime kiln as a heat transfer apparatus, kiln capacity, rating proper kiln proportion and operation were discussed.

In Part V, which appeared in the August 1st number, the different methods of firing were discussed.

This sixth article completes the discussion of the subject as it was prepared by Mr. Azbe for the Seventh Annual Convention of the National Lime Association held at Briarcliff Manor, New York, May 26, 27, 28, and 29, 1925.

Editor

Lime Kiln Running Periods and Lime Kiln Refractories

Kiln running period between repairs is in some cases quite long; in others, however, it is very short. Figure 16 shows a kiln life record of a particularly bad case. The average life of kiln lining in the firing zone was less than 60 working days for an entire year. In one case in this particular plant the kiln had to be taken off the lime after twenty-seven working days. Even shorter time than this is on record. It was a very bad condition indeed, and neither the man in charge of the plant, the refractory salesman, nor the engineers knew the reasons for this refractory wearing condition. In a plant such as this the load factor naturally is very poor. Out of four kilns one had to be down all of the time for repairs, and they would come down when lime was most needed. There was no consistency to the running period. It may have been one month or two months, so the repair period time could not be regulated so as to fall into a period of slack lime demand.

Figure 17 shows another case where conditions were much better. The load factor was 83.9 per cent; that is, the kilns were of this percentage of lime. Often all kilns were working, none idle, which every one will admit is very good when there are only eight kilns available. Running periods were obtained as long as 13 months, and there were very few short periods except in the case of experimental kilns.

The reasons for short kiln life may be numerous and may be summed up as follows:

1. The brick used may be of poor quality, one that will soften or fuse at temperatures lower than the kiln temperature.

2. The brick may be of a kind that will readily combine with lime to form silica-alumina-lime slag which will have a much lower fusing temperature than the brick itself.

3. The clay in the brick may be good, but it may be improperly pressed or burned presenting a porous body or one that will cause shrinkage in the walls.

4. The walls may have been poorly made. Joints may be too great, brick corners chipped, brick poorly lined up, or improper clay may have been used for bonding. Brick may also be of unequal dimensions and will not make good solid walls.

5. The brick may have a high coefficient of expansion which will give it a tendency to spall. The brick shapes may also have been so large that proper adjustment to temperature differences was impossible and spalling resulted.

6. Structural details of kiln construction may be wrong. The span of the arches may be too great, or an improper size of brick may have been used. The weight on the inner kiln walls may be too great.

7. Combustion of fuel may be

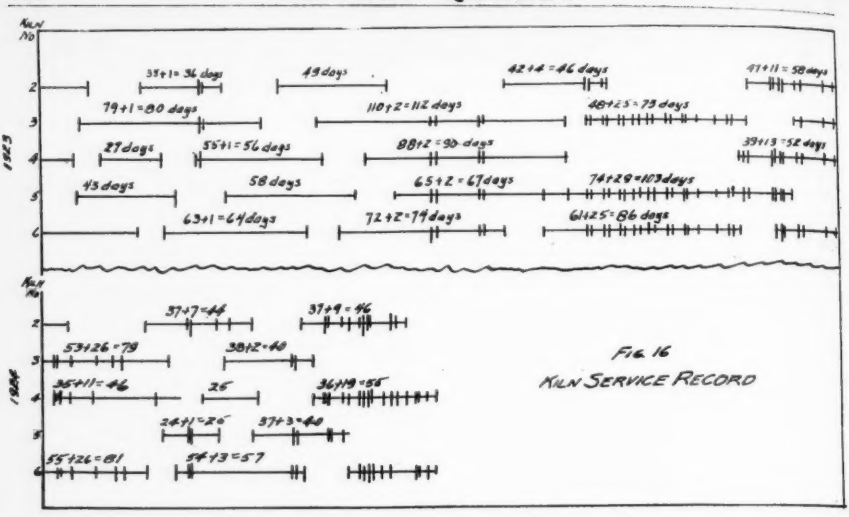


FIG. 16
KILN SERVICE RECORD

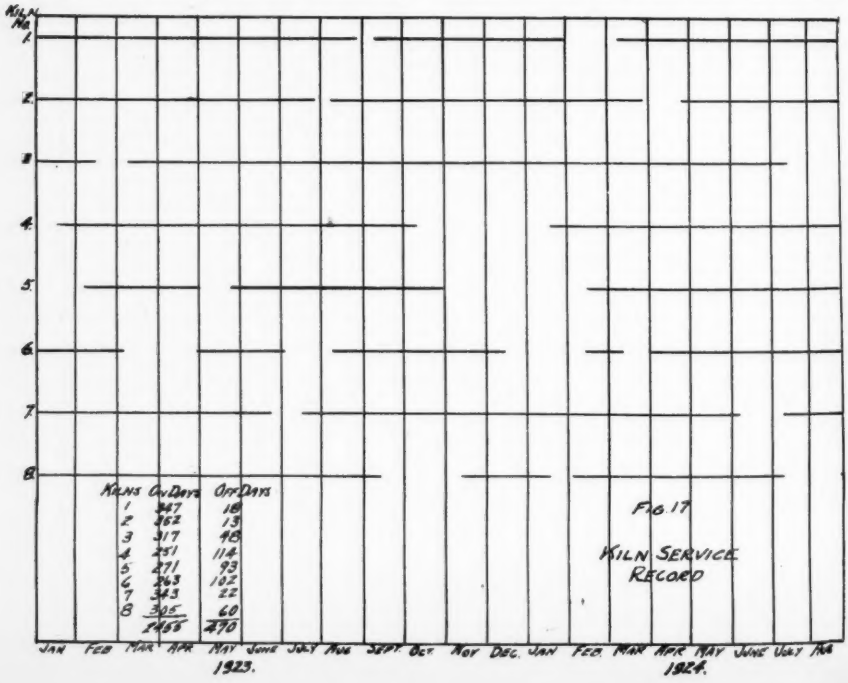
wrong, such that an intense short flame is obtained instead of a mild long flame. The heat may be concentrated too greatly at localized points.

8. Combustion chambers may be too large, using too much air to burn the fuel. The flame is agitated and quicker combustion results.

9. The drawing of lime may be wrong. Completely burned lime may be left where temperatures are high, or the kiln may be cooled considerably during drawing, causing expansion and contraction strains.

10. The kiln may be so designed and operated that the flame has a tendency to sweep up the kiln walls rather than to penetrate into the kiln.

The following recommendations are fundamental to good kiln operation:



Kilns	On Days	Off Days
1	347	18
2	352	13
3	317	48
4	251	114
5	271	93
6	263	102
7	343	22
8	305	60
	2468	470

FIG. 17
KILN SERVICE RECORD

1. Use good brick generally in the hot zone.
2. Use exceptionally good brick at critical points such as the inner arch of the kiln eye.
3. Retard combustion by using primary and secondary air, by using CO_2 to retard combustion, by having small combustion space, by mixing the gases as little as possible before they enter the kiln.
4. Have as little joint area as possible and use proper binder between the brick.
5. Have the kiln designed so the hot zone is jacketed which facilitates repairs. Pass air through the jacket, but be sure to use the heat so abstracted in the hot zone of the kiln.
6. Relieve the hot zone lining of as much load as possible, and transfer the load to the outer cooler and stronger brick.

All of this appears very simple, but we are not sure that we know what good brick is, or what exceptionally good brick is. We are only guessing. We also know very little about retarded combustion and proper structural kiln design.

Figure 18 gives the relative heights of 14 different lime kilns used in this country. The heights from the base of the firing zone up range from 20 to 58 feet. This chart is shown, not to argue regarding high or low kilns, but rather to illustrate the state of inconsistency of lime manufacturing today. Most of the design is empirical and has to be so because data is unavailable to build kilns upon a scientific basis. Is there any one who could state with scientific accuracy what is the proper height of a kiln or the shape of the kiln shaft for a certain definite ca-

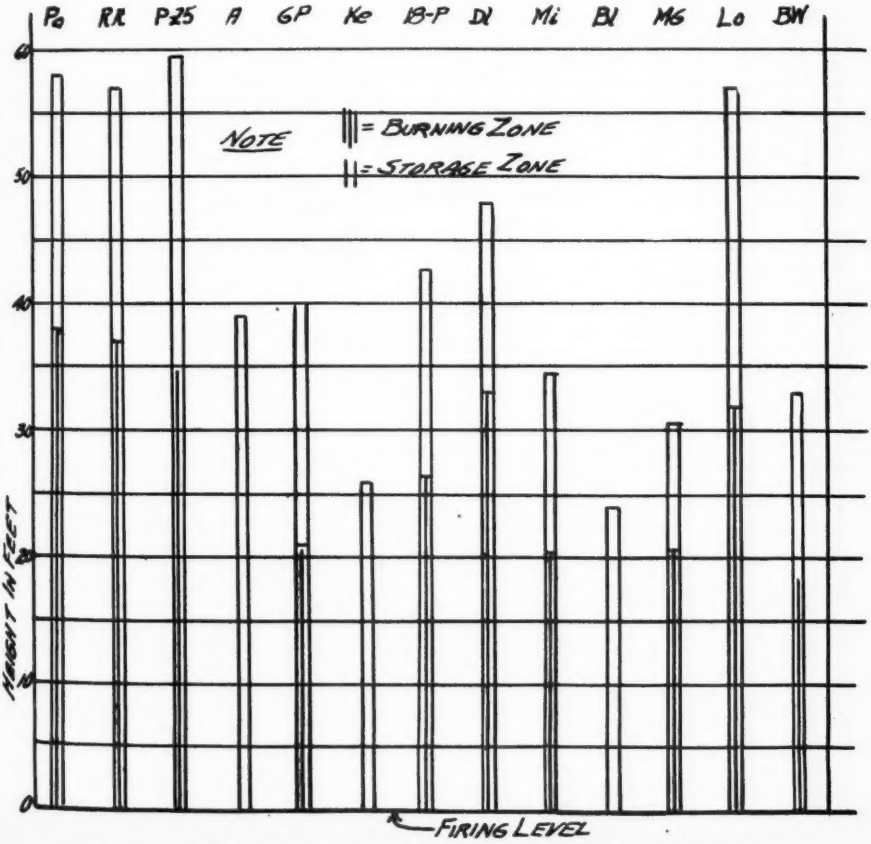


Figure 18—Variation in Height of Representative American Lime Kilns

to another is an element that somepacity and height efficiency? There is no doubt that some think they know; but since there are so many deciding factors that are imperfectly understood, I believe that those who think they know are mistaken. The really efficient kiln has not been built yet. It is still in evolution, and it will remain so for many years to come. We are building kilns that are only approaching the goal.

The number of peculiarities of lime kilns that lack definite explanation is surprisingly great. The man who has had experience with many types of kilns realizes this. Each one has different characteristics. It is collective information, gathered from study of many different kilns over long periods, that will eventually make possible the definite formulation of kiln design and kiln operation. When that time comes, kiln thermal efficiency will be 60 per cent or better. A ton of lime will be obtained out of every 100 cubic feet of kiln space; kiln life will extend into long periods, possibly years; kiln labor costs will be low; and lime will be good, neither contaminated with impurities from the coal nor over-burned.

Farrell-Cheek Bulletins

Several new publications have been issued by the Farrell-Cheek Steel Foundry Co., of Sandusky, Ohio, excellent in point of typography and illustrations.

"The illustrated Story of a Farrell-Cheek Steel Casting," as the name implies, presents to the reader both a visual and narrative review of this company's steel plant, showing step by step the various departments and processes of manufacture. The "steel casting" to be described is a hydraulic press part. The order first goes to the pattern shop where the new patterns are made. After shellacking these are sent to the pattern storage department. From here it goes to the moulding department, and the making of sand moulds and cores is described, and the production of the finished product. Views are shown of the melting or furnace division of the foundry and the electric furnaces, the cutter room, final inspection and the weighing and loading rooms. Numerous black and white sketches help to illustrate the various kinds of machinery and equipment in which Farrell-Cheek castings are used.

"Farrell's 85—A Special Purpose Cast Steel," is a smaller booklet whose object is "to define the distinctive characteristics of Farrell's 85 Cast-Steel and to submit evidence, by test and analysis, of our belief that it is a worthy contribution to the manufacture of better steel castings." This book describes the developing of "Farrell's 85" cast steel, the manufacturers' object being to produce "a Cast Steel that would cost less and still contain those favorable properties peculiar only to the more expensive Alloy and Manganese steels, possessing great merit for certain classes of Casting requirements."

"Hardening Pots and Boxes" describes the successful effort to produce a steel with unusual heat-resisting qualities, to enable hardening pots and boxes to withstand the severe heat to which the structure of any metal is continually subjected in hardening and annealing furnaces.

Traylor's Pocket Catalog

The pocket edition of General Catalog No. 2000, recently issued by the Traylor Engineering & Manufacturing Company of Allentown, Pa., is a brief description of this well-known company's products. The products described are such as are used in stone crushing, gravel recovery, sugar refining, cement making, coal and flue dust briquetting, mining, ore dressing and sundry other industries.

Although descriptions are necessarily of the briefest character, sufficient information is given, together with tabular data, to acquaint the reader in a preliminary way with Traylor products.

Among the products described are: The Bulldog Jaw Crusher, Bulldog Junior, Type A, Dodge Type, Bulldog Gyratory, Finishing Gyratory, Heavy Duty Crushing Rolls, Extra Heavy Duty Crushing Rolls, Stone Elevators, Rotary Screens, Feeders, Crushing Plant Accessories, Crushing Plants, Ball Mills, Rod Mills, Finishing Mills, Rotary Kilns and Dryers, Cement Plants, Briquetting Machinery, Portable Air Compressors and Motor Trucks.

The Economy Centrifugal Pump

AS MANUFACTURERS of a complete line of centrifugal pumping machinery the Economy Pump Machinery Company has frequently been called upon to furnish pumps driven by small gasoline engines. With the increasing demand for such apparatus, Economy engineers made an extensive investigation of performance requirements. They found that built-up pump units had many disadvantages, and that a great improvement in performance could be made by especially designing a pump to fit the engine used. The result of this conclusion has been the development of the 3 inch type "FHS" Economy Centrifugal pump driven by 5 H.P. New-Way gasoline-kerosene engine.

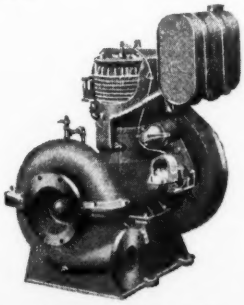
This unit is very sturdy and compact, and is so proportioned that it will handle the maximum amount of water under all heads, and yet it will never demand the exertion of full engine power. This feature is of great importance for field work, because a laboring engine requires a great deal of attention, while one which is slightly underloaded will run continuously and smoothly without nursing. For portable or intermittent water supply, or drainage, this unit has demonstrated its tremendous value. It is furnished with or without truck as desired.

The pump casing is of cast iron, of the single suction horizontal split type, so arranged that access may be had to all interior parts without disturbing the discharge pipe or the alignment of the unit. This construction is used in the highest grade of stationary water works pumps because of its simplicity and accessible construction.

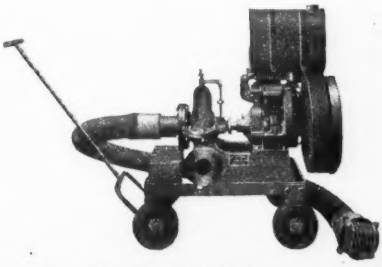
The impeller is cast iron or of bronze if desired and is the single suction enclosed type, with very large passages to permit the handling of a large percentage of solid matter. It is accurately machined, balanced, keyed to the engine crank shaft and absolutely located in place by a shoulder and a nut. By mounting the impeller on the engine crank shaft in this manner pump bearings are eliminated and the over all length of the unit very much shortened. The crank shaft is encased in a renewable bronze sleeve through the stuffing gland; this sleeve protects the crank shaft from wear and corrosion. The stuffing glands are bronze with swing bolt adjustment.

The standard equipment consists of companion flanges on both suction and discharge openings, stuffing box packing, fuel tank and float feed carburetor. When desired the unit will be mounted on a steel frame hand truck of the type shown in the illustration. Smooth bore, 4 inch suction hose, foot valve and strainer, discharge valve, hand primer, or any other standard fittings can be furnished.

The "New-Way" Engine which is air cooled will deliver its full power for any length of time in any climate without any possibility of overheating. An American Bosch Magneto insures ignition reliability. The power varies from 2 to 5 H.P. and is controlled by an automatic throttling governor. The Engine is equipped with float feed automobile type carburetor which insures easy starting, high economy and smooth operation. All wearing parts are enclosed and run in a bath of oil, giving dust proof, perfect lubrication. It is mechanically and accurately balanced to eliminate vibration.



The Economy Pump



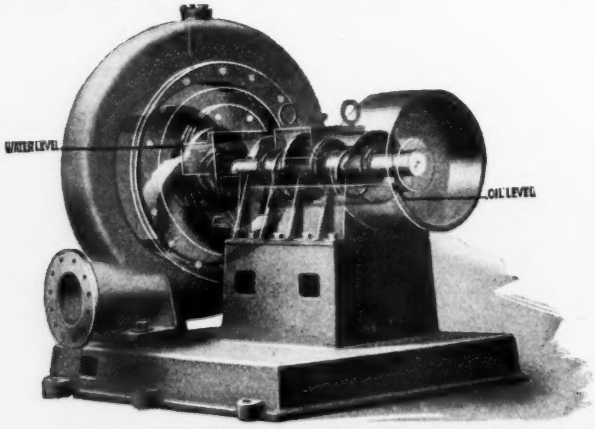
The Portable Unit

Tampa Dredging Pumps

AN efficient centrifugal dredging pump has been perfected by the Tampa Shipbuilding and Engineering Company of Tampa, Florida, which concern is located in the pebble phosphate region of Florida where 60 per cent of the phosphate of the world is being produced.

The Tampa Company has believed for years that a square shaped shell is far superior to the arched shaped shell, for the reason that the material being thrown by the runner against the periphery of the arched shaped shell will seek to find the center of the arch or the largest diameter of the shell, which causes an obstruction because of the material meeting in the center of the arch from each side. It is for this reason that the Tampa Shipbuilding and Engineering Company believes that a square shaped shell will handle a great deal more and will last longer because the wear is evenly distributed over the full width of the pump shell. They also claim that it will require considerably less power to handle material with a square shaped shell than with the common arched shell.

The Tampa dredging pump has several other features. One is an absolute water seal over the stuffing box gland by which air leaks are made impossible and at the same time the packing may be left free and loose. Another item is its lubrication. The two bearings as well as the thrust collar are always running in a bath of oil. Oil rings carry a stream of oil over the shaft and thrust collar constantly. In the larger size pumps roller thrust collars are provided. The company manufactures these pumps in sizes of 4, 6, 8, 10, 12, and 15 inches.



The Tampa Centrifugal Pump

Electric Controller Bulletins

Six new bulletins together with twelve Price Sheets have been issued by the Electric Controller & Mfg. Co. of Cleveland, Ohio, also a Bulletin Index and Checking List No. 2, for the E. C. & M. Bulletin Binder.

Especial attention is called to the new Bulletin No. 1048 Type Z O Oil-immersed push button operated across-the-line Starting Switch for small A. C. Motors. This switch is provided with the E. C. & M. expansion wire overload device, and the overload trip contacts as well as the main contacts are under oil. The company states it is now able to furnish either air-break or oil-break across-the-line starters, and the new Type Z O oil-break starting switch is lower in price than the Type Z B air-break switch which they have been manufacturing for some time.

Bulletin No. 1040-B includes a New Youngstown Safety Limit Stop for electric cranes of compact dimensions.

Bulletin No. 1042-E has been revised to include the new Type J Master Switch, now supplied as standard with E. C. & M. Automatic Compensators.

Hydraulic production and handling

HANDLING large volumes of sand and gravel that can be washed down into a sump and carrying it from there through pipe line to truck, car or scow, is an economical method where a good supply of water is available.

Mining phosphate in Florida by means of 12-in. Morris Motor-driven Dredging Pump and Morris Jet Pump delivering two 2½ in. streams at 125 lb. pressure.

We build jet pumps of suitable types for all pressures up to 200 lb. per sq. in., and Morris Dredging Pumps for delivery of material through lines of great length. Both types can be arranged for easy shifting from place to place.

Typical applications are described in our Bulletin 20, sent free on request, and the advice of our Engineers is free for the asking.

Morris Machine Works **Baldwinsville, N. Y.**

Originators of Centrifugal Pumps, both single and multi-stage, and builders for practically all purposes since 1864

Branch Offices: New York, 39-41 Cortlandt St.; Philadelphia, Forest Bldg.; Cleveland, Engineers' Bldg.; Chicago, 217 N. Jefferson St.; Boston, 79 Milk St.; Pittsburgh, 320 Second Ave., Detroit, Penobscot Bldg.; Charlotte, Realty Bldg.; Richmond, 708 Mutual Bldg.; Houston, 119 Main St.

Sales Representatives: Buffalo, St. Paul, Kansas City, Denver, Salt Lake City, Seattle, Portland, Ore., Los Angeles, New Orleans.

MORRIS
CENTRIFUGAL PUMPS

"WE BUY—REBUILD—SELL OR RENT"

HOISTS

Large quantity late model American double-drum with attached swinging gear, capacity 6000 pounds; on a single line at 162 ft. per minute; either hand levers or levers banked in quadrant. Can furnish either 37 H.P., 440 or 220 volt, A.C., 60 cycle, 3 phase, alternating current, or 35 H.P., 220 volt, direct current, or can furnish without electrical equipment suitable for gasoline or belt drive.

CARS

20—36-in. ga. Continental, 4 yd. heavy duty, rebuilt like new.
15—Lakewood 30-in. ga., V shape, 1½ yd., all steel Dump Cars.

STEAM SHOVELS

3—78C late '23 models, 30-ft. boom, 19-ft. dipper stick, 3-yd. dipper, one on railroad trucks, two on caterpillars.
1—50B Bucyrus full revolving on caterpillars, 26-ft. boom, 17-ft. dipper stick, 1¾ yd. dipper new November, 1923.
1—Type "B" Erie on caterpillars, ¾ yd. bucket.

DERRICKS

Large quantity late model American Stiff Leg Derricks, mast 14x14x40 ft., booms 14x14x60 ft., stiff legs 14x14x50 or 60 ft., sills if desired, with 12 ft. steel bull wheel, for hook work or bucket operation.
Large quantity late model American Stiff Leg Derricks, mast 16x16x40 ft., boom 14x14x80 ft., trussed with hog rods, legs and sills 14x14, with 16 ft. steel bull wheel, arranged for hook work or bucket operating.

LOCOMOTIVES

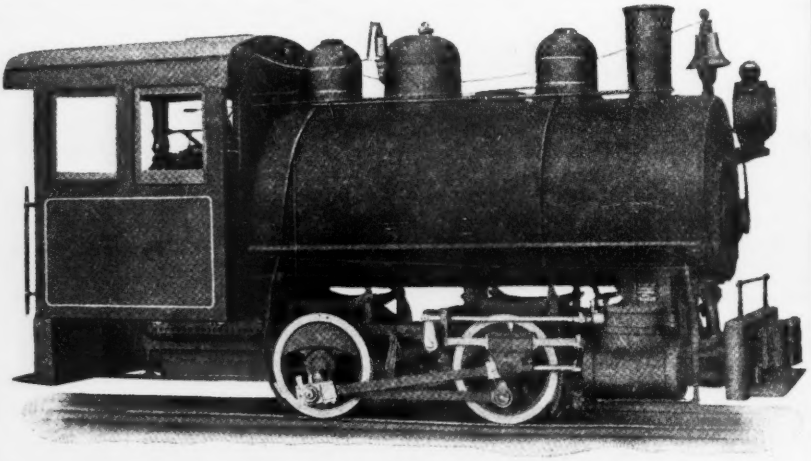
3—Porter std. ga., saddle tank, 14x22 cylinder, weight 42 tons, like new, only one year of service, shop Nos. 6770, 6852, 6853.
1—Davenport std. ga., 20 ton, 10x16 cylinders, saddle tank. No. 1497.
3—Porter 36-in. ga., 18 ton, saddle tank, 10x16 cylinders, rebuilt like new. Nos. 4619, 4667, 6805.
3—7 ton, 24-in. ga., Plymouth, gasoline.
5—3 ton, 24-in. ga., gasoline, 2—Plymouth. 3—Whitcomb. —Fordson.

Equipment Corporation of America

Philadelphia
660 Land Title Bldg.
Phone Rittenhouse 5498

CHICAGO, ILL.
1460 Roanoke Bldg.
Phone Randolph 6586

Pittsburgh
860 Empire Bldg.
Phone Grant 5148



2—Standard Gauge 11" x 16"—22 ton, 4 Driver saddle tank locomotives, 170 pounds steam pressure; steam brakes. Completely rebuilt. Immediate shipment.
HAVE OTHER LOCOMOTIVES IN STOCK, REBUILT AND READY, 5 to 125 tons, narrow and standard gauge; various types.

Steam Shovels—Dump Cars—Cranes—Rails, etc.

SOUTHERN IRON & EQUIPMENT CO.
(Est. 1889) ATLANTA, GA.

Service

Realizing what a tremendous factor time is on many construction jobs, we have established storage yards at points from which we can make the quickest possible delivery of both rails and equipment to any part of the country. Purchasers of H-M rails or equipment, therefore, enjoy the fullest advantages of greatest speed and substantial savings in hauling charges.

We also maintain a corps of experienced rail men ready to go anywhere at any time in the service of those desiring to buy or sell. With Hyman-Michaels, no order is too large to handle—*none too small.* In fact, our great capacity has been developed through conscientious, helpful service to all classes of buyers.

We solicit inquiries, regardless of requirements, and *we invite rush orders.*

HYMAN M MICHAELS

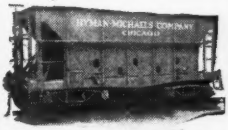
Rails and equipment bearing the H-M stamp are invariably the choice of experienced buyers

We always have locomotives of every type in I.C.C. condition ready for immediate delivery at prices that mean big savings to the user.

Every engine in our yards has been overhauled, tested under steam and put in first class condition.

Road, Switch, Geared, Narrow and Standard Gauge Engines.

Write for prices and blue prints.



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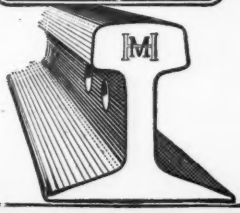
Dump, Ore, Box, Flat, Refrigerator, Gondola, Hart Convertibles, Cabooses and Passenger.

All in serviceable condition.



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Select Used Railway Equipment

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New York Pittsburgh St. Louis

Pacific Coast Representative:

United Commercial Co., San Francisco

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For Sale or Rent

LOCOMOTIVE CRANES

1—No. 8 Browning, 8 wheel, 50 ft. boom
1—10-ton Bay City, 4 wheel

STEAM SHOVELS

1—Type "B" Erie on caterpillars
1—14B Bucyrus on caterpillars
1—No. 20 Marion on trucks

MISCELLANEOUS

Hoisting Engines, Pumps, Derricks, Clamshell Buckets, Concrete Mixers.

PITTSBURGH MACHINERY & EQUIPMENT CO.
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SURPLUS EQUIPMENT

(Buy it right off the job and get it cheap.)

BOATS	DRAGLINES	PIPE
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CABLEWAYS	FORMS	SHOVELS
CARS	FINISHERS	TRACTORS
COMPRESSORS	GRADERS	TRUCKS
CONVEYORS	HOISTS	TRACK
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I have equipment located in practically every state in the Union.

ALEXANDER T. McLEOD
First Nat'l Bank Bldg., Chicago

SCREENING PLANT EQUIPMENT

All in first class condition. To be sold at a sacrifice.

2—Revolving Screens, 20 ft. by 60".
2—Allen Sand Tanks.
3—10 x 6 x 10 hor. dup. piston Pumps.
1— 8 x 8 Buffalo Forge Upright Engine.
1— 6 x 6 Donegan-Swift Upright Engine.
1—Crocker Wheeler 18 Kw Generator.
1—200 H. P. Scotch Boiler, 125 lb. steam.

MURRY-PERRY, INC.
Port Jefferson, Long Island, N. Y.

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1—20-ton, 8-wheel, OHIO Locomotive Crane, Shop No. 3641, new 1924. A.S.M.E. and Mass. boiler, 50 ft. boom; bucket operating; M.C.B. trucks, perfect condition.
1—McMYLER No. 2, full revolving 8T" CRAWLER CRANE, new 1925, ALL STEEL CATERPILLARS, A.S.M.E. boiler, 40 ft. boom, bucket operating; used only three months.

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25—12-yd. std. gauge, WESTERN, two-way Hand Dump, Heavy Duty, STEEL DRAFT BEAMS, 19 ft. beds, Box Girder Doors, M.C.B trucks, overhauled, first class condition.
35—4-yd. 36 in gauge, KOPPEL, two-way side dump, new 1924, Heavy Duty, STEEL DRAFT BEAMS, like new.

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Railway Type, Mang. Dippers
Crushers, #10, 9, 8, 7½, 6, 5, 4, 3,
Roll Crushers
84x72, 36x60, 54x24, 18x30
Jaw Crushers
22x52", 36x42", 42x48", 20x24", 15x36"
DISC CRUSHERS, 43", 36", 24", 18"
120 H.P. Gasoline Engine
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2—200 H.P. MOTORS S RING
440 v., 60 cy., 3 ph., 435 rev., G. E.
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1—No. 4½ Champion Jaw Crusher. Price, $750.00.

1—9x15 Blake Jaw Crusher. Price, $650.00.

1—No. 3 McCully Gyratory Crusher. Price, $750.00.

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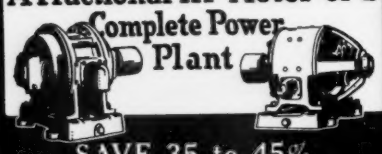

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Every machine completely overhauled and tested — Guaranteed
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The FUERST-FRIEDMAN Co.
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4—24" gauge Gasoline Locomotives
3—Miles of 24" gauge Industrial Track
62—Batch Box Carrs
124—Batch Boxes

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All machines listed are in first class condition and guaranteed complete with fittings same as are furnished on new machines.

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1—396 ft. Class WB-2 Sullivan 2 stage
1—534 ft. X-2 Ingersoll steam compressor
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1—558 ft. Class WB-2 Sullivan 2 stage
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The above all designed and built for 100 to 150 lb. steam pressure and to deliver air at 80 to 120 lb.

1—16x16x14 XB-1 Imperial Ingersoll-Rand belt driven compressor built for 30 lb. terminal air pressure. Capacity 1000 ft.

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1—14x36 R.H. Hamilton Corliss
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1—Wm. A. Box Iron Works Company Electric Hoister, No. 80—16688; Rope Speed 700 ft. P.M. Pull 5500 lb., double drums 42x29 in. Complete with 112 H.P. G.E. Motor 3 ph. 60 cy. 440 v. 690 r.p.m. (This equipment practically new.)

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30 Ton 12-lb. Rail
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Three No. 1, Two No. 1½ and One No. 2 Sturtevant Rotary Fine Crushers.

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Two No. 3 Gates, One No. 4 Gates, Two No. 5 Gates, Two No. 6 Gates & McCully, Two No. 7½ Gates and Austin, Three No. 8 Gates & Traylor, One No. 9 Gates Gyratory Crushers.

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Three 9"x15", One 10"x20", Two 12"x24", One 15"x30", One 18"x36", One 24"x36", and One 36"x42" Jaw Crushers.

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Two 10"x16", Three 10"x30", Two 16"x36", Two 16"x42", and One 24"x54" Crushing Rolls. Swing hammer mills and other types.

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One 4'x40', One 5'x50', Two 6'x60', One 6'x125', One 7'x60', Rotary Kilns.

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600—50-Ton All Steel Double Hopper Cars.

(400 have rolled steel underframes and 200 have pressed steel underframes)

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Scrapped Iron in all its Forms
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22—Marion and Bucyrus, mounted on Cat. Trac. Wheels and R. R Type from ¾ to 4-yd. cap.

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8—7x10 D/D's Am La. Ldg. Mundy.
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DRAGLINES
10—Dragline Outfits, including Monighan, Bucyrus, Fairbanks Morse, and Marion, ranging from ¾ to 4-yd. cap.

DERRICKS
1—Wood Stiff Leg, 60-ft. Boom.
20—Others ranging from 3 to 20 tons.

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Rennolds Equipment Co., 36 W. Van Buren St., Chicago, Ill.

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5½x8" American D.C. D.F.D. with boiler.
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800 ft. span cable way complete with Lambert Engine.

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550 cu. ft. belted Ingersol-Rand.
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8'x20' Revolving Screen.

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42"x150' Elevator bucket belt.
Boilers and Engines various sizes.

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For Sale or Rent
12-ton BROWNHOIST No. 4331, 4 wheel, standard gauge, steam driven, self-propelling, double drums, 40 ft. 9 in. boom, steel cab, ballast and cable, good condition.
40-ton INDUSTRIAL No. 2895, 8 wheel, standard gauge, steam driven, self-propelling, double drums, 70 ft. boom, ASME boiler, outriggers, ballast, cable and fall block. Overhauled.
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BELT AND MOTOR DRIVEN
177 ft. Ingersoll, "ER-1".
360 ft. Chicago, "NSB" with motor complete.
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1500 ft. Ingersoll Imperial "XB-2".

STEAM DRIVEN
360 ft. Chicago, "NSS."
690 ft. Chicago, "GST."
750 ft. Bury, "CPP."
1190 ft. Ingersoll, "X-2."
2300 ft. Ingersoll, "X-3."

Other Types and Sizes.
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1—No. 9 Gates, style K gyratory, manganese fitted.
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4—Symons Disc—48"-36"-24"-18".
1—No. 2 Telsmith Reduction
1—No. 5 Austin gyratory.
1—No. 4 Gates.
1—Climax Portable, 10"x16".

SHOVELS AND DRAGLINES
1—50-B Bucyrus, 1¾-yd. bucket, caterpillar.
1—Marion Model 37 Electric, 1¼-yd. dipper, caterpillar.
1—Marion Model 36, 1½-yd bucket, caterpillar.
1—Northwest Model 105, caterpillar.
1—Erie type B, caterpillar.
2—Erie type B traction.
2—No. 0 Thew's caterpillar.
1—Northwest Model 104, 1-yd. Page bucket, caterpillar.
1—Bucyrus, class 9½, caterpillar.
1—Bucyrus, class 14.

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All sections, new and second hand.
Centrally located. Also Cars of all kinds.
Immediate shipment guaranteed.
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LOCOMOTIVE CRANES
15 Ton—Orton & Steinbrenner with 45" Magnet. Price $5,000.00.
10 Ton—McMyler with ¾ Ton Bucket. Price, $2,000.00.
10 Ton—Industrial with Hook. Price $2,000.00.
Located in Chicago. Specifications upon request.
BRIGGS & TURIVAS
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FOR SALE

STEAM SHOVEL

Marion 36—Caterpillar type; good condition; working daily. Bargain. Address P. O. Box 263, Mexico, Mo.

FOR SALE

1—150 Bucyrus Steam Shovel, 2½ yd. dipper.
1—175 Bucyrus Steam Shovel, 3½ yd. dipper.
1—35B Bucyrus Steam Shovel, 1½ yd. dipper.
1—No. 6 Keystone Excavator with Skimmer scoop.
1—7½ ton and 1—14 ton steam Locomotives.
2—150 H.P. high pressure Boilers.

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PITTSBURG, KANS.

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OHIO CRANE

Locomotive type; good condition; ship on own wheels. Sacrifice. Address P. O. Box 263, Mexico, Mo.

FOR SALE

1—Stedman No. 40 Disintegrator
1—American Pulverizer
Machines used for experimental purposes only.

Bryn Mawr Sand and Gravel Co.
131 Holden Street, Minneapolis, Minn.

For Sale — Pulverizer

1—No. 18 Universal Pulverizer with ⅜, ¾ and 1¼" Grate Bars. This machine as good as new. Priced at a bargain.

Leesburg Silica Sand Company
NEW CASTLE, PA.

For Sale—36" Ga. Dump Cars

19-8-yd. double truck, two-way side dump cars. Tennessee delivery. Bargain price account bankruptcy former owners.

DEMPSTER EQUIPMENT CO.,
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Wanted—Small Crushing Rolls

Give number, size, make and price and where the same can be inspected.

Leesburg Silica Sand Company
NEW CASTLE, PA.

Wanted to Purchase

22 ft. tube mills silex lined; air compressor, portable, gas driven, capacity to operate rotating hand rock drill; 1,200 ft. of 2" galvanized steam pipe.

INTERNATIONAL SILICA CO.
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T. H. LETSON CO.

Good Used Equipment Hudson Terminal Bldg. **NEW YORK** **Clean Business Methods**

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STEAM SHOVELS

1—½-yd type A Erie Caterpillar.
1—¾-yd. type B Erie high lift, traction wheels.
1—¾-yd. type B Erie No. 1566 on Caterpillars.
1—¾-yd. type B Erie No. 1769 on Caterpillars.
1—⅞-yd. A1 Thew on Traction Wheels.
1—1-yd. 30-B Bucyrus on Caterpillars.
1—2½-yd. No. 60 Marion R. R. trucks.
1—5-yd. No. 91 Marion R. R. trucks.

CRANES & EXCAVATORS

1—No. 4 Keystone Excavator No. 4296, with skimmer scoop and trench bucket.
1—15-ton 8 wheel 50' boom O & S Locomotive Crane.
1—5-ton Traction Wheel Steam Crane.

HOISTS (STEAM)

1—No. 3½ Dake Swinger.
1—6¼x10 three drum and boiler Mundy.
1—7x10 single drum Skeleton Lidgerwood.
1—7x10 D. C. D. D. Lidgerwood and Boiler.
1—8½x10 three drum and boiler Lambert.
1—10x12 D. D. and Swinger Skeleton Lidgerwood

HOISTS (ELECTRIC)

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1—10 ton 80' boom 14" x 14" Terry Timber Stiff Leg with 12' Bullwheel.
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1—¾-yd. Page Dragline.
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1—12 in. Centrifugal Pump Dredge
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No. 8-HHD Erie Dredging pump and extras. 320-355 ft. Am.-Fairhurst Compressor. 7½x6 Worth'n Compr.—15 H.P. motor—new 6x6—WG—6 Sullivan Compr. Not worn, $140. New 45 H.P Turbines; D-Well Pumps, etc.
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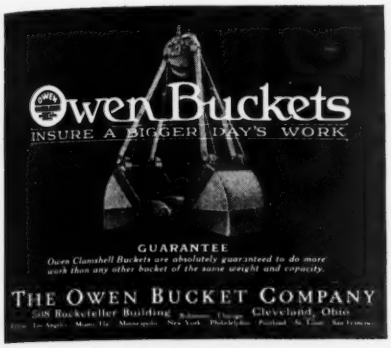
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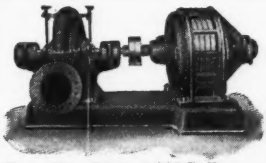

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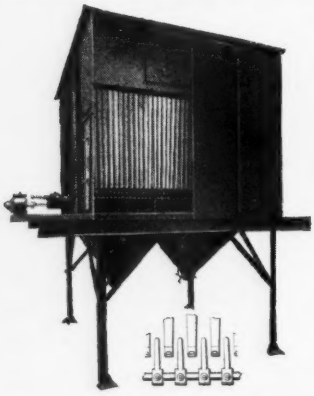

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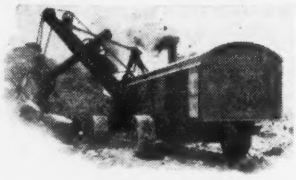

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It shows actual installations

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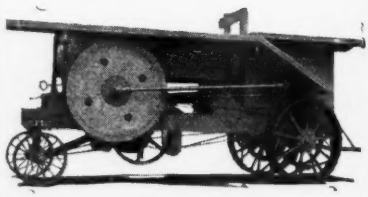

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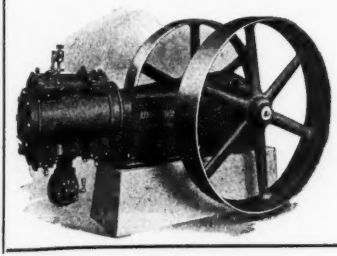

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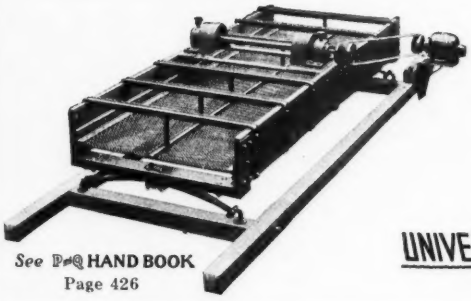

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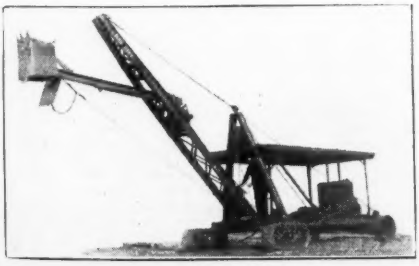

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Fills the gap between hand labor and high priced equipment. Several hundred in operation, gasoline or electric power.

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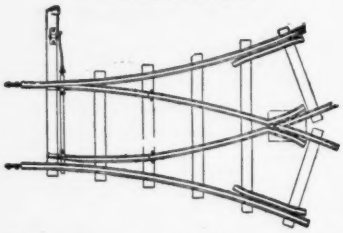

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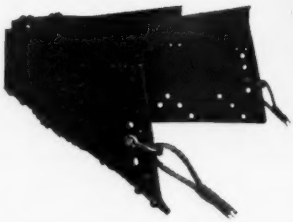

For excavating and conveying. It is the most efficient Power Drag Scraper on the market and adaptable to a large number of jobs.

Our catalog will help you decide, as it will show many installations under various conditions. Send for your copy.

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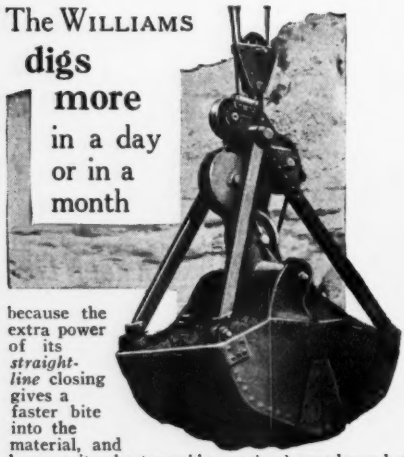
Monadnock Block **Chicago, Ill.**

The WILLIAMS **digs more** in a day or in a month



because the extra power of its *straight-line* closing gives a faster bite into the material, and because its shorter cable overhaul speeds up both the opening and closing.

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All Parts Guaranteed Against Breakage

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85, 135, 210 and 300 Ton Capacities.

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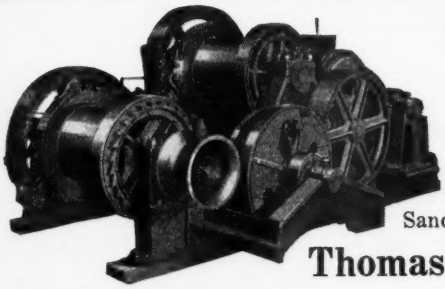

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Steam and Electric

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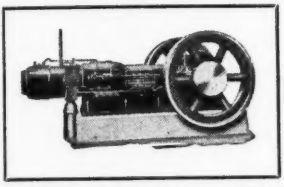

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Cost least for repairs.
Burns low grade fuel.
One gallon lubricating oil operates 90 h. p. for 33 hours.
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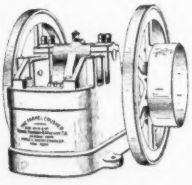

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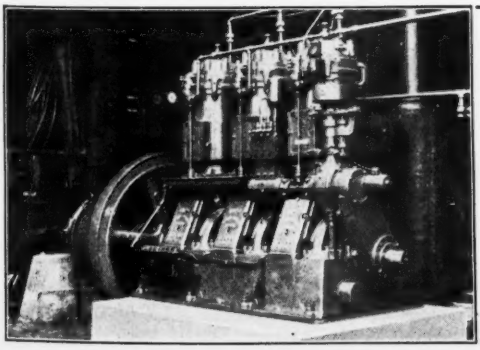

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They are equally advantageous to the small operator. Easy operation and rapid, hard-biting drilling ability are features of Wood Drills. Economy is a third big item, because they are easy to operate and they are durable and foolproof. Send for literature and prices.

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OUTPUTS—1-40 TONS PER HR. FINENESS—20-200 MESH.

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Portable and Stationary Plants

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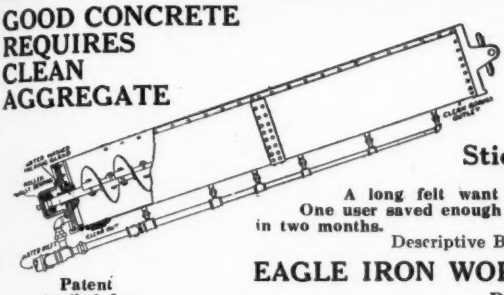

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Removes Mud Balls, Sticks, Coal and Shale.

A long felt want that actually does the business. One user saved enough to pay for the cost of this washer in two months.

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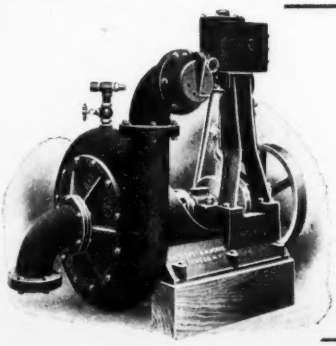

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Sand & Gravel Pumps
with and without Liners

Water Pumps — Steam Engines
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Extra Heavy Side Suction Type
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For Industrial Haulage

BUILT in sizes from four to fifteen tons. For all Gauges of Track. There's a size for every purpose.

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STANDARD FOR 33 YEARS

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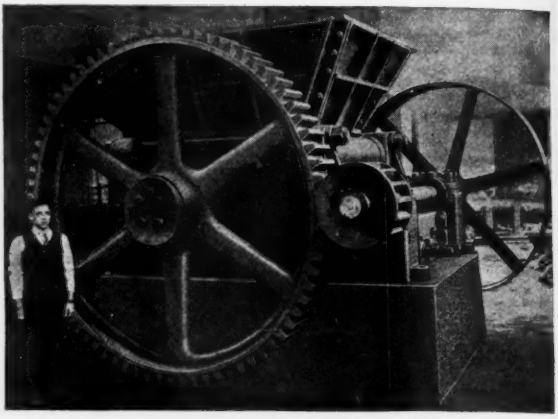

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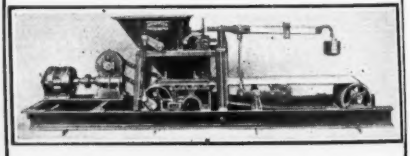
NO SPRINGS

No delicate contrivances, yet a machine is not obtainable that will weigh more accurately than

THE POIDOMETER



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Enables materials to be handled continuously or in bulk as desired.

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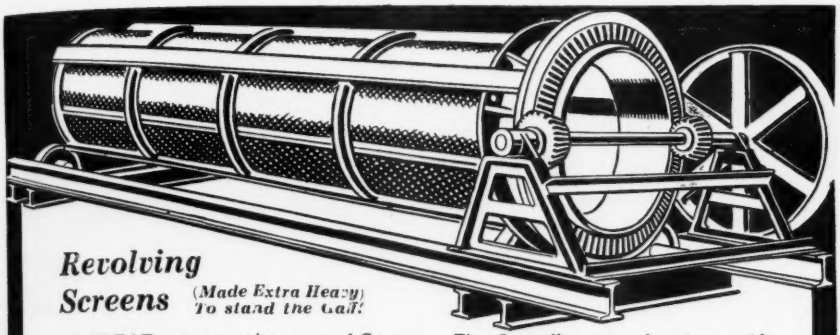

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It is made in sizes to meet all requirements. Screens are extra heavy, mounted on Hardwood Timbers. This assures a straight running screen at all times. Supplied in sections, two to twelve feet long, any size perforations, either punched plate or Manganese Steel.

All Steel Screen with Manganese, Bevel Gears and Pinions, Tread Wheel and Rollers.

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Gruendler Swing Hammer Crushers and Pulverizers, elevating machinery, and Road Building Equipment are known for their satisfactory, economical service.

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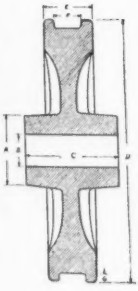

DOUBLE FLANGE TRAVELING CRANE SEMI-STEEL WHEELS

Egyptian semi-steel castings will meet the most exacting requirement for durability and service.

We suggest it would be to your advantage to place our name on your Purchase list for Egyptian Semi-Steel Crane Truck Wheels, Sheave Wheels, Gang Saw Truck Wheels, Channeler Wheels, etc.

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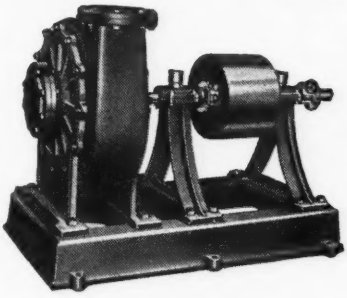
MURPHYSBORO, ILL.

Lightning Pumps



Will Give the Service

It is a superior pump for sand and gravel dredging because of its greater capacity and simplicity.

A complete description of these rugged pumps will show you that they are the right pumps for your work. Write for our Pump Bulletin.

KANSAS CITY HAY PRESS CO.
KANSAS CITY, MISSOURI

Long Service—Low Upkeep

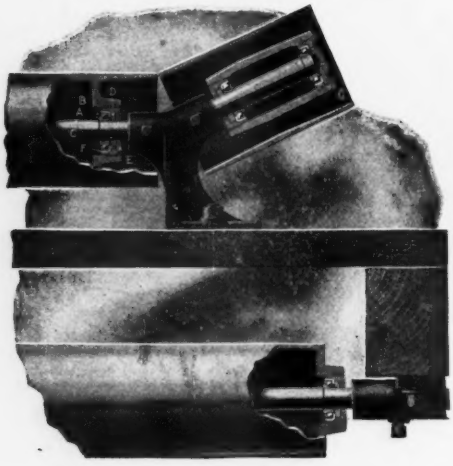
There is one test of quality and character in industrial locomotives that is convincing beyond any other. That is long, hard service. There are many examples of this sort of tests. The following from the Richland Shale Products Company of Columbia, S. C., is typical.

"The Fordson type locomotive you furnished us during April, 1924, has been in constant service since that time, hauling four 1½-yard cars of shale per trip, up a 5% grade, on 60-lb. rails, and our only repair expense so far has been for brake shoes and one set of tires. This locomotive is in excellent condition today and apparently good for years of economical operation. We are well pleased."

Write us today for Bulletins B-1 and B-4, which contains complete specifications. Our Engineering Department will gladly help you with your haulage problems without cost or obligation.

BROOKVILLE TRUCK & TRACTOR COMPANY
Brookville, Pa., U. S. A.

ELIMINATE IDLER FRICTION



Write for detailed information

Conweigh Ball Bearing Idlers are smooth running, and durable, being made of hardened steel well reinforced. They give easy access for lubrication.

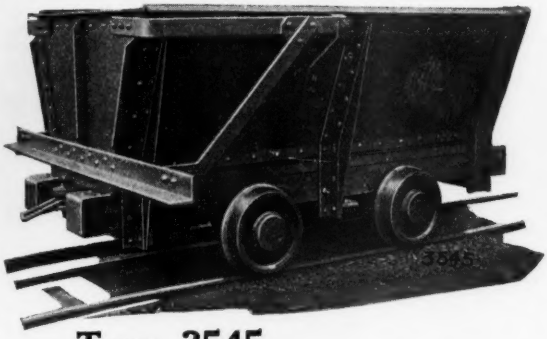
More and more the demand in plant equipment is for intensive development and greater perfection in details. Conweigh Ball Bearing Troughing and Return Idlers represent a detail improvement which affects the whole conveying system of a plant. Because of the smooth, easy service they give, belt conveyors operate with far greater efficiency.

Get complete details on "Conweigh" Idlers. Made in all sizes. Write today.

We are the original inventors and builders of belt conveyors equipped with ball bearing idlers.

THE CONVEYING WEIGHER COMPANY
90 West Street ENGINEER & CONTRACTOR **New York**

EASTON QUARRY CARS



Responsibility

Perfection of product is a more laudable aim than perception of profit.

No manufacturer of quarry cars can afford to shirk responsibility for his product by hiding behind the walls of a detailed specification.

Type 3545
Bulletin 21
shows other types of quarry cars.
Sent on request.
"Quarry Car Practice"
Published Every Now and Then

Easton Car & Construction Co.
Kansas City, Mo.—Easton, Pa.

Sales Offices
New York, Chicago, Pittsburgh
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EASTON CARS
FOR EVERY PIT MINE & QUARRY

Quarry face 1,600 feet long and 50 feet high being broken up by means of explosives detonated with Cordeau-Bickford

For one or for two hundred drill holes, use the safe, sure, and efficient detonating agent, Cordeau-Bickford. Even though you have no power line, you can still shoot any number of holes you desire by using Cordeau-Bickford.

Write for booklet today.

The Ensign-Bickford Company

Original Manufacturers of Safety Fuse
Established 1836
SIMSBURY, CONNECTICUT

American Wire Rope

FOR
DRAG LINES
POWER SHOVELS
DERRICKS

AMERICAN
STEEL & WIRE
COMPANY

Chicago New York

The Serviceable Conveyor

Easily raised, lowered and moved about, the Burch All Steel Portable Conveyor will load any kind of material at the rate of a yard per minute. One day you can work from stock pile and the next day direct from pit. Because of its portability it can easily be jumped from one loading job to another.

In addition to the advantages named, the belt of this Conveyor is especially adapted to handling abrasive material. It runs in trough style, which gives larger carrying capacity and preserves the edges. Furnished with gas or electric motor. Write today for our descriptive catalog and prices.

THE
BURCH PLOW
WORKS CO.
CRESTLINE, OHIO

DEPENDABLE "DOMESTIC" POWER UNITS

Increase Your Efficiency

The one big purpose of "Domestic" Air Compressors is to increase the efficiency of drilling by cutting down the time and cost and increasing the ease of operation. They will duplicate the work formerly requiring a dozen or more men by the old hand method.

"Domestic" Air Compressors are furnished mounted on steel truck, rubber tired trailer or ready to mount on truck chassis. They are manufactured in sizes of 50, 62, 92 and 184 cu. ft. displacement of free air per minute.

A 184 Cu. Ft. "Domestic" Air Compressor Mounted on Rubber Tired Trailer

Write for Bulletin "MCP" describing our line of Dependable Power Pumps, Hoists and Air Compressor Units.

Domestic Engine & Pump Co.

Manufacturers

SHIPPENSBURG, PENNA.

PUMPS — AIR COMPRESSORS — HOISTS

ELEVATORS, SCREENS
Conveyors & Equipment

WHATEVER your needs in mechanical handling and screening equipment for sand-and-gravel or quarry plant, you will profit by getting in touch with this Company. We carry an extensive stock and shop facilities for turning out your needed equipment in short order.

In thinking of a new or enlarged plant you will want our Catalog 623 for ready reference. **Ask for it.**

Manufacturer of THE GEORGE -Truck and- Wagon Loaders Portable Belt Conveyors

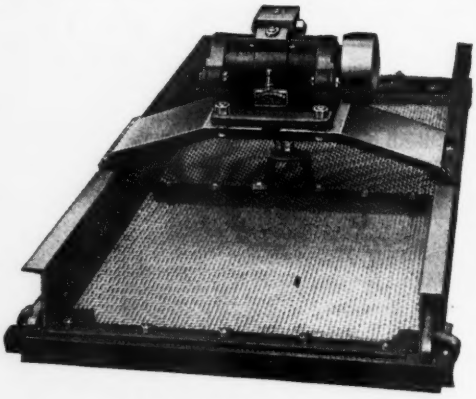
HAISS

Established 1892 MFG. CO. INC Clam Shell -Buckets- Mail Handling Equipment.

142nd St. and Rider Ave., New York, N. Y.

Representatives Throughout the World
Cable Address "Coalhoist" New York—"Western Union 5 Letter Edition" Code

Leahy NO-BLIND Vibrating SCREENS



Will Screen Anything— Wet or Dry

VERY LOW POWER CONSUMPTION ½ H. P.

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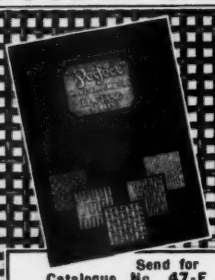
THE DEISTER CONCENTRATOR COMPANY

635 High Street
FORT WAYNE, INDIANA

New York Office:
60 Water St.

DOUBLE CRIMPED WIRE CLOTH



Send for Catalogue No. 47-E
It lists a thousand screens.

"Perfect" Service

1 Most **COMPLETE** wire cloth **SERVICE**
2 Most **ACCESSIBLE** wire cloth **SERVICE**
3 Most **RELIABLE** wire cloth **SERVICE**
4 Most **ADAPTABLE** wire cloth **SERVICE**
5 Most **ECONOMICAL** wire cloth **SERVICE**

The LUDLOW-SAYLOR WIRE COMPANY St. Louis
610 South Newstead Avenue

CYCLONE NUMBER FOURTEEN BIG BLAST HOLE DRILLS

Whatever success Cyclone No. 14 Big Blast Hole Drills have attained in the quarry industry during the fifteen years of their existence has been due to close adherence to the following ideals and principles:

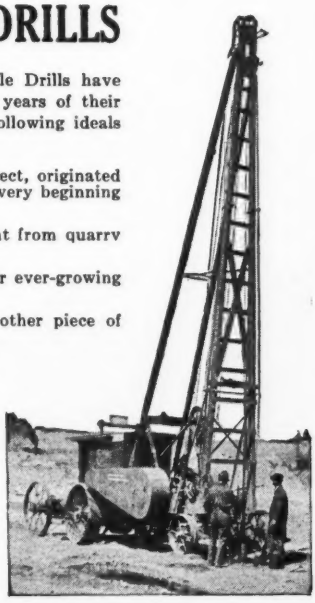
1—Starting with a design that was basically correct, originated after a close study of the requirements at the very beginning of the use of well drills in quarrying.

2—Always welcoming suggestions for improvement from quarry operators.

3—Keeping in close touch with the field and their ever-growing requirements.

4—Never holding the idea that a drill or any other piece of machinery could be perfect or faultless.

The story of the development of Cyclone No. 14 drills is completely told in our 100-page catalog B-45. It also contains 40 pages of cost and operating data on quarry drilling and blasting. Ask for a copy.



THE SANDERSON-CYCLONE DRILL CO.

Orrville, Ohio

Eastern & Export Office:
30 Church St., New York City

SPEARWELL MOGUL LOADER

A Strictly One Man Machine

CAPACITY 1½ to 2½ CU. YDS. PER MINUTE
Weight 14,000 lbs.

Equipped with positive and efficient excavating, feeding and cleanup device.

Clears path 8 feet wide.

Guaranteed to excavate harder material and to clean up better than any loader of its kind on the market, bar none.

40 H.P. 4 cyl. Heavy Duty Buda Motor.

Positive self-cleaning track, 1500 square inches of bearing surface, less than 10 lbs. per square inch.

Digging and crowding speeds 4 and 20 ft. per minute. Traveling speeds ½ to 2½ miles per hour.

Digging position quickly and easily adjusted and absolutely maintained by special grade control shoe.

Swivel chute controlled from operator's platform, permits loading in any position.

Write for literature and prices on Spearwell Loaders—a size for every need.

SPEARS-WELLS MACHINERY CO.
Manufacturers of SPEARWELL CONSTRUCTION EQUIPMENT
Oakland, California

SALEM
Genuine

Elevator Buckets

Since 1880, when Salem Buckets were awarded First Premium for superiority, no other make of bucket has approached the Salem, in quality, long wear or unusual service.

Write for Catalog No. 3625

Fig. 1080 — Reinforced Edge — particularly suitable for handling abrasive or otherwise difficult material.

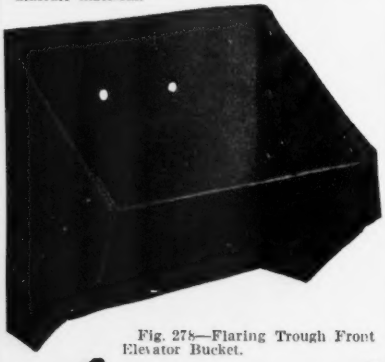


Fig. 278—Flaring Trough Front Elevator Bucket.

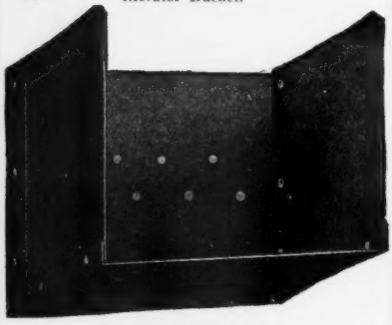
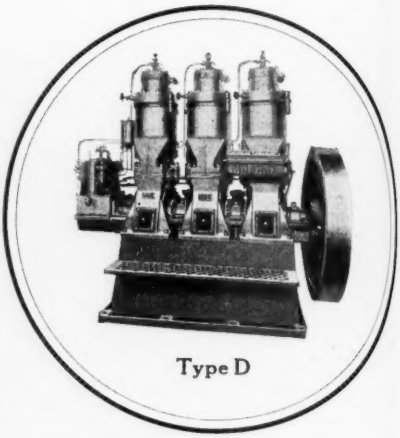


Fig. 736—Acute Heel Shelf Bucket, with straight ends.

MULLINS BODY CORP.
Successors to W. J. CLARK CO.
106 Mill St. Salem, Ohio

VENN-SEVERIN OIL ENGINE

Dependable Power



Type D

Economy Plus Endurance

WHETHER installed in sand, gravel or quarry plants, for stationary or portable service, the type "D" Venn-Severin Oil Engine will show maximum economy and will survive the hardest kind of work, year after year.

This efficiency is due to clean combustion. eliminating carbon accumulation, low compression, which does away with excessive internal strains and compact, rigid vertical design, giving perfect balance and greatest possible strength, without vibration.

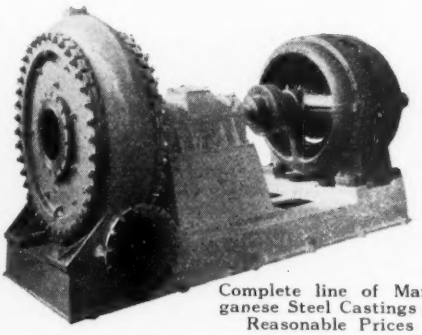
Especially adapted to Dragline work. Sizes range from 15 to 250 H. P.

VENN-SEVERIN MACHINE CO.
1317 West North Ave.
CHICAGO

THE ECONOMICAL POWER UNIT

PVC Manganese Steel Castings

A Diamond Pump



Complete line of Manganese Steel Castings at Reasonable Prices

The Diamond Pump is made of manganese steel, the toughest known metal and is durable and strong. It is designed according to principles that long experience in building pumps has proven to be best.

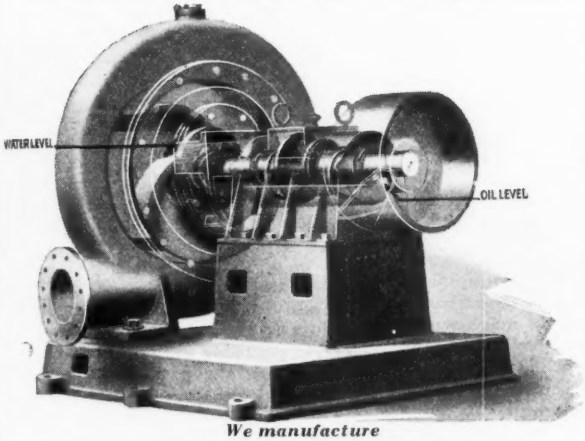
Diamond Pumps are built in all sizes, belt driven or direct connected motor driven.

Send pump inquiries to:

W. H. K. BENNETT
20 E. Jackson Blvd., Chicago

PETTIBONE MULLIKEN CO.
Chicago, Ill.

Tampa Dredging Pumps Are The Best



We manufacture
4", 6", 8", 10", 12" and 15"
either direct connected to motor or belt driven

The curves of our runner flights are shaped right.

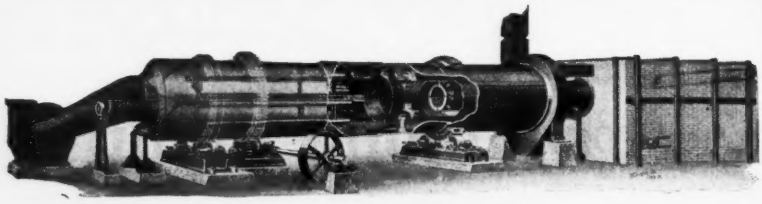
Our square shaped shell avoids spiral motion in discharge.

Our water seal makes air leaks impossible.

Our oiling system eliminates lubricating troubles.

Our yardage production is unequaled.

TAMPA SHIPBUILDING & ENGINEERING CO.
TAMPA, FLORIDA
WRITE FOR PRICES, DESCRIPTION and OUTLINE BLUE PRINT



Buckeye Type B Dryer

Correct Drying Principles

The qualities responsible for Buckeye Drying Success are

Efficiency—Economy of Operation—Low Fuel Costs—Thorough, Uniform Drying—Endurance of Hard Usage—Quick Regulation.

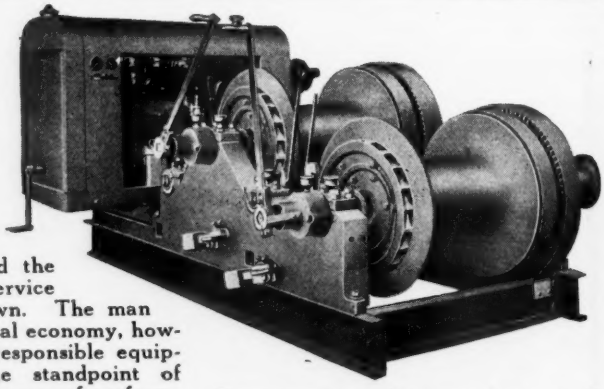
White materials are dried without discoloration. We build six different types of dryers and can furnish each type in six different sizes.

Write for descriptive booklet. Our Engineering Department will solve your drying problems.

THE BUCKEYE DRYER CO.

1351 Railway Exchange Bldg., Chicago

Avoid Costly Breakdowns by Investing in an O. K. Hoist



O. K. Hoists stand the gaff of the hardest service without breaking down. The man who is interested in real economy, however, will not buy irresponsible equipment, and from the standpoint of length of service and power of performance, they cost less and do more work.

All O. K. Hoists are sturdy, comparatively light, and easily moved about. All have generated machine-cut tooth gears, solid machine steel driving pinion, asbestos lined drums and give 100% results.

The O. K. Air Compressor

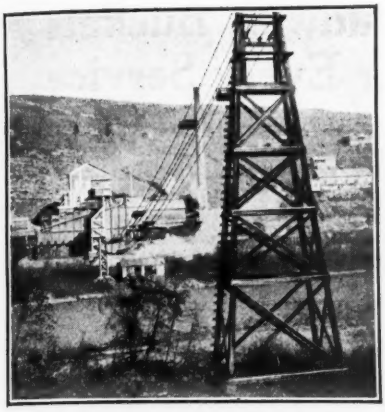
The O. K. Clutch and Machinery Company has added another valuable product to their line. The gasoline and electric portable air compressor, manufactured in three sizes, the same in design and construction.

This product contains the same rugged construction and great efficiency that is characteristic of O. K. products.

Write for complete information regarding our hoists and air compressors.

O. K. CLUTCH & MACHINERY CO.

BOX 305, COLUMBIA, PA.



AN
IMPORTANT
FACTOR
IN
EFFICIENT
and
MODERN
QUARRY
OPERATIONS
is

HAULAGE

Automatic Aerial Tramway

Solves this Problem Efficiently and Permanently
Let Our Engineers Study Your Problem

INTERSTATE EQUIPMENT CORPORATION
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Use Curtis Compressors

For all drilling and other quarry operations requiring pneumatic tools—use compressed air supplied by a Curtis Model "A." Fully enclosed Controlled Splash Oiling Compressor.

Curtis Model "A" Air Compressors are the result of over 28 years spent in the design and manufacture of air compressors known everywhere for their advanced engineering features, extreme durability and all-round mechanical excellence. They are full self-oiling through means of a controlled splash regulatable sight feed lubrication system. Heads, valves and cylinder walls are water cooled and present a greater cooling surface than in double-acting compressors of equal capacity. This feature increases volumetric efficiency. Fully enclosed—dust and dirt proof. Built in various sizes and capacities up to 250 b. displacement.

Write for further details — ask for Bulletin C-3

CURTIS PNEUMATIC MACHINERY CO.
1628 Kienlen Ave. St. Louis, Mo.

Branch Office:
531-K Hudson Terminal, New York City

Model "A"

CURTIS
1854 71st ANNIVERSARY 1925

Curtis Pneumatic Machinery Co., 1628 Kienlen Ave., St. Louis, Mo.

Gentlemen: Please send full details on Curtis Air Compressors.

Name .....

Address .....

Caldwell Buckets for Every Service

CALDWELL Buckets are built to give efficient performance under trying tests and widely varying conditions.

The Continuous Steel Bucket is especially adapted for handling cement, stone, crushed rock and other heavy material, and is made in various gauges of steel, to suit all requirements. They are accurately formed, and joints may be either riveted or spot welded.

No wedging of material, or sharp corners. May be arranged to overlap, thus forming a continuous bucket elevator. Loads fully, with even, complete discharge.

When considering bucket equipment, for any or all needs, remember the name, CALDWELL. Remember, also, the names of Caldwell users, gladly furnished on request.

H. W. CALDWELL & SON CO.

LINK-BELT COMPANY, OWNER

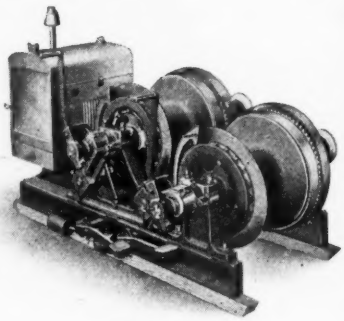
Chicago, 1700 S. Western Ave.
New York, 2676 Woolworth Bldg.
Dallas, Texas, 810 Main St.

CALDWELL

O. & S. Hoists

Our line of Hoists covers Steam, Electric and Gasoline in Single, Double or Triple Drum and with or without Boom Swinging Attachment.

Write for descriptive Bulletins.



ORR & SEMBOWER, Inc.

READING, PENNA.

Established 1885

50 Church St.
New York City

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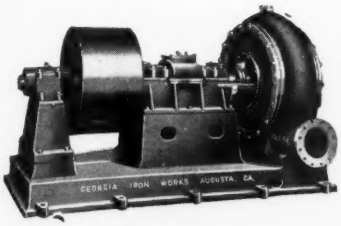
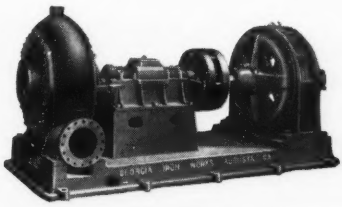
Chicago, Illinois

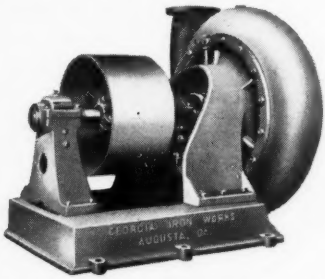
Hydraulic Equipment



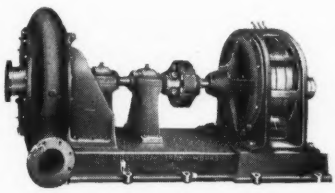
Heavy duty belt driven sand and dredging pump built in 8", 10", and 12" sizes.



Heavy duty directly connected motor driven sand and dredging pump. Built in 8", 10", and 12" sizes.



Overhanging type belt driven sand and dredging pump. Built in 6" and 8" sizes.



Overhanging type sand and dredging pump on extended base directly connected to motor.

The manufacture of Hydraulic Equipment for stripping and mining has been our specialty for a number of years, and our product has given highly satisfactory service in a variety of operations in different sections of the country.

The Land Pebble Phosphate Rock operations in South Florida represent probably the most extensive and modern use of Sand and Dredging Pumps in any one industry in the United States. When the magnitude of the production, the high standing and national repute of the companies in that field are considered, it is quite significant that 95% of the hydraulic guns and sand and dredging pumps used by the land pebble phosphate rock industry for the past 10 years have been manufactured and supplied by us.

Our line, as partially shown in cuts above, embraces a type and size pump for any sand and gravel operation. In addition to these pumps we build hydraulic guns, (giants), and a full line of flanged fittings.

Inquiries solicited and quotations submitted promptly.

GEORGIA IRON WORKS, Augusta, Georgia

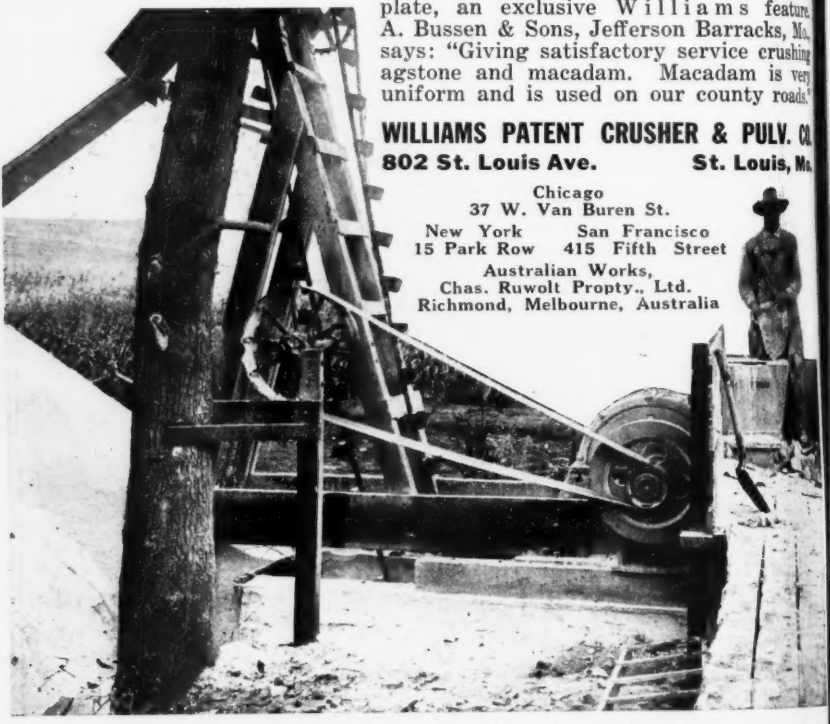
Established 1891

The "Jumbo Jr." Crushes 16" Rock to Macadam or Agstone in One Operation

Cleaner Macadam

Although handling larger rock the Jumbo Junior can be adjusted to make macadam with no more fines (usually less) than jaw or gyratory crushers. Product is also cubical with no slivers. Indiana State Farm, Greencastle, Indiana say: "Makes best prepared stone state highway department has used."

To the operator who wishes to cut sledge work—to handle larger rock and crush in one operation to the required size, the "Jumbo Junior" type offers a real saving. Operating by the Williams Hinged Hammer Principle it is quickly adjustable to make any size finished material including clean macadam, water bound macadam, top dressing or agstone. These quick and positive adjustments are made possible by the patented adjustable front end and breaker plate, an exclusive Williams feature. A. Bussen & Sons, Jefferson Barracks, Mo., says: "Giving satisfactory service crushing agstone and macadam. Macadam is very uniform and is used on our county roads."



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